TRANSCRIPT OF RECORD.

SUPREME COURT OF THE UNITED STATES.

No. 248.

GEORGE CROMPTON, APPELLANT,

vs.

THE BELKNAP MILLS.

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE DISTRICT OF NEW HAMPSHIRE.

FILED AUGUST 20, 1869.

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INDEX.

	Original.	Print.
Bill of complaint	5	1
Answer	11	5
Replication	19	9
Complainant's re-issue patent	20	11
TESTIMONY FOR COMPLAINANT.		
Deposition of Henry B. Renwick	29	16
Deposition of Hervey Waters	47	28
TESTIMONY FOR RESPONDENTS.		
Deposition of Edward S. Renwick	73	43
Letters patent of Samuel T. Thomas (No. 13,187)	113	68
Letters patent of Samuel T. Thomas (No. 34,381)	124	74
Letters patent of Thomas and Everett (No. 8,810)	130	77
Deposition of F. C. Treadwell, jr.	132	78
Deposition of Robert Davis	172	103
Deposition of Daniel H. Kelly	186	112
Deposition of James C. Wing	190	115
Deposition of Elisha Allen	194	117
Deposition of Leonard Pierce	203	123
Deposition of Albert Marshall	211	128
Deposition of Edward S. Renwick (recalled)	212	129
Deposition of F. C. Treadwell, jr. (recalled)	217	131
Deposition of Ira Allen	222	135

COMPLAINANT'S REBUTTER.

	Original.	Print.
Deposition of Horace Wyman	247	149
Deposition of D. M. Downes	259	157
Deposition of George Crompton	264	160
Deposition of James Cook	280	169
Deposition of Thomas Barrows	285	173
Deposition of Samuel T. Thomas	288	175
Deposition of Edward Barrows	291	176
Deposition of Henry B. Renwick	292	177
Deposition of Horace Wyman (recalled)	324	196
Deposition of Hervey Waters (recalled)	331	200
Deposition of George Crompton (recalled)	351	213

ADDITIONAL TESTIMONY FOR RESPONDENTS.

Deposition of Edward S. Renwick (recalled)	354	215
Deposition of Francis C. Treadwell, jr. (recalled)	382	232
Deposition of Merrill D. Richardson	399	243
Deposition of D. H. Kelly (recalled)	404	246
Deposition of Robert Davis (recalled)	407	247
Deposition of Benjamin G. Adams	410	249
Deposition of Robert Davis (recalled)	417	254
Deposition of Jonathan E. Chase	420	255
Deposition of William Wiesner	423	257
Deposition of James Schofield	425	258
Deposition of Joseph M. Thompson	433	263
Deposition of William Robinson	435	264
Deposition of F. C. Treadwell, jr. (recalled)	435	265
Deposition of Joseph Clissold	437	266
Deposition of George Crompton (recalled by respondents)	439	267
Deposition of F. W. Reeves	442	269
Deposition of Samuel T. Thomas (recalled)	442	269
Deposition of James Schofield (recalled)	446	272
Deposition of Robert Davis (recalled)	451	274
Deposition of D. H. Kelly (recalled)	452	275

ADDITIONAL TESTIMONY FOR COMPLAINANT.

Deposition of James Crompton	467	282
Deposition of James Tetlow	471	285
Deposition of E. D. Thayer	479	290
Deposition of Charles Dawson	480	290
Deposition of Susan Monahan	483	292
Deposition of Horace Wyman (recalled)	486	294

COMPLAINANT'S EXHIBITS, ETC.

Exhibit A. Model Marshall loom	30	17
Exhibit B. Model Thomas loom	31	18
Exhibit C. H. Bachofner's patent	548	329
Exhibit D. Model	110	67
Exhibit E. Sketch of sector	165	99
Exhibit F. Model	169	101
Exhibit G. Piece of cloth first woven	248	150
Exhibit H. Piece of cloth second woven	248	150
Exhibit J. Piece of cloth third woven	248	150

	Original.	Print.
Exhibit K. Lever	260	157
Exhibit L. Weighted lever	261	158
Exhibit M. Grooved ear with spring	261	158
Exhibit N. Drawing	319	194
Exhibit O. Samples of fancy woolens	325	197
Exhibit P. Latch	397	242
Exhibit Q. Latch	398	242
Exhibit R. Piece of cloth	475	287
Exhibit S. Piece of cloth	481	291
Assignment from Moses Marshall to G. Crompton	560	335
Covenant of Moses Marshall with G. Crompton	561	336
Assignment of Moses Marshall to G. Crompton	562	337

RESPONDENT'S EXHIBITS, ETC.

Exhibit 1. Cam sector without eccentric portions	93	57
Exhibit 2. Thomas patent	113	68
Exhibit 3. Thomas patent	124	74
Exhibit 4. Thomas and Everett patent	130	77
Exhibit 5. Model of open-shed loom at Middlesex Mills	206	125
Exhibit 6. George Crompton patent	552	331
Exhibit 7. Marshall letters patent	226	137
Exhibit 8. William Crompton patent.	233	141
Exhibit 9. John Rostron specification	237	144
Exhibit 10. William Crompton model	226	137
Exhibit 11. Drawing	317	192
Exhibit 12. Drawing	350	212
Exhibit 13. Marshall petition, &c.	454	275
Exhibit 14. Marshall order notice, &c.	456	276
Exhibit 15. Marshall file wrapper and contents	458	277
Exhibit 16. Marshall extension, file wrapper, and contents	496	299
Notice time of hearing Marshall's application for extension	433	264
Decree	19*a*	10
Appeal	19*a*	10
Appeal bond	19*a*	10
Clerk's certificate	19*d*	11
Clerk's certificate	563	337

5 In the circuit court of the United States, begun and holden at Portsmouth, within and for the district of New Hampshire, on the eighth day of May, A. D. 1869:

Present, Hon. Nathan Clifford. } Judges of said court.
" Daniel Clark. }

GEORGE CROMPTON
vs.
THE BELKNAP MILLS & JAMES BAILEY.

On the sixth day of October, A. D. 1864, the complainant files in said court here his bill of complaint as follows:

To the honorable the justices of the circuit court of the United States within and for the district of New Hampshire, sitting in equity:

George Crompton, of Worcester, in the district of Massachusetts, and a citizen thereof, brings this his bill against the Belknap Mills, a corporation established by law of, and located within, said district of New Hampshire, and James Bailey, of Laconia, in said district, superintendent of said corporation.

And thereupon your orator complains and says that, before the eleventh day of December, in the year 1849, one Moses Marshall, then a citizen of the United States, being, as your orator is informed and believes, the original and first inventor of a certain new and useful improvement in looms for weaving figured fabrics, which had not been in public use or on sale, with his consent or allowance, more than two years, did make application in due form of law to the government of the United States for its letters patent for such improvement; upon which application such proceedings were had that, on the said eleventh day of December, letters patent of the United States, dated the said eleventh day of December, signed by the Secretary of the Interior, and countersigned and sealed with the seal of the Patent Office by the Commissioner of Patents, were issued and delivered to the said Marshall for the said invention, entitled an improvement in looms for weaving figured fabrics, whereof there was granted to the said Marshall, his heirs, administrators, or assigns, for the term of fourteen years from the said date thereof, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, as in
6 and by the reissue of said letters patent to be presently referred to, and now produced and shown unto your honors, will more fully appear.

And your orator further shows unto your honors that afterward, to wit, before the fifth day of May, in the year 1859, by his deed of that date, duly recorded in the United States Patent Office, the said Marshall assigned, sold, transferred, and set over to your orator all right, title, and interest in, to, and under said letters patent, as by said deed of assignment, or a certified copy thereof, with the indorsements of the recording thereof, now produced and shown unto your honors, will more fully appear.

And your orator further shows unto your honors that, upon the said fifth day of May, by his deed of that date, the said Marshall covenanted and agreed to and with your orator, his executors, administrators, and assigns, to sell, assign, and convey to him or them, for a certain consideration therein named, all right, title, and interest whatever in, to, and under any extension or extended term which might be from the United States Patent Office thereafter obtained of said letters patent, as by said

covenant, now produced and shown unto your honors, will more fully appear.

And your orator further shows unto your honors that afterwards, to wit, before the twenty-fourth day of April, in the year 1860, the said letters patent, being inoperative or invalid by reason of a defective specification, were surrendered according to law and cancelled, and new letters patent, bearing date the said twenty-fourth day of April, signed by the Secretary of the Interior, and countersigned and sealed with the seal of the Patent Office by the Commissioner of Patents, did issue for the same invention, on an amended specification granting to your orator, his heirs, administrators, or assigns, for the remainder of the term of fourteen years from the said eleventh day of December, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, therein entitled an improvement in looms for weaving figured fabrics, all which, by the said reissued letters patent now produced and shown unto your honors, will more fully appear.

And your orator further shows unto your honors that afterwards, to wit, on the eighth day of December, in the year 1863, and on the
7 petition of the said Moses Marshall, said reissued letters patent were, by said Commissioner of Patents, renewed and extended according to law for the further term of seven years from the eleventh day of December, in the year 1863, as by the indorsement upon said reissued letters patent, now produced and shown unto your honors, will more fully appear.

And your orator further shows unto your honors that afterwards, to wit, on the nineteenth day of December, in the year 1863, by his deed of that date duly recorded in the United States Patent Office, said Moses Marshall did assign, sell, and transfer unto your orator, his heirs, administrators, and assigns, all right, title, and interest in, to, and under said extended term, as by the original assignment, or a certified copy thereof, with the certificate of record thereon indorsed, now produced and shown to your honors, will more fully appear.

And your orator further shows unto your honors that the said Moses Marshall has always, from the time of the granting of said original letters patent up to the time of the assignment to your orator as hereinbefore stated, and that your orator has always since the time of said assignment, and in the exercise of the full and exclusive right and liberty so granted as aforesaid, made, constructed, used, and vended to others to be used, the said improvement so patented, and looms embracing the same, and have had and maintained, until the infringement hereinafter complained of, exclusive possession of the said improvement and invention under and by virtue of said letters patent, and have never acquiesced in any invasion or infringement of their said rights.

And your orator further shows unto your honors that the said corporation, defendant herein, having full knowledge of the premises, and in violation of your orator's exclusive right and privilege as aforesaid, and utterly disregarding the same, has since the date of the said reissued letters patent, and both before and after the extension of said letters patent, and while said exclusive right was in your orator as aforesaid, without the license of your orator, at Laconia and elsewhere in the district of New Hampshire, and at various other places in the United States, manufactured, used, and sold, and still continues to manufacture, use, and sell, looms embracing the improvement so secured
8 to your orator, in large numbers, but how many your orator is unable to set forth, but he prays that the respondents may discover and set forth in answer to this bill.

And your orator further shows unto your honors that the said James Bailey, superintendent, joined in this bill as defendant with the said Belknap Mills, is such officer thereof, and well acquainted with its business, and able to answer upon his personal knowledge or information and belief whether or not these your orator's charges are true.

And your orator further shows unto your honors that he will be subject to great and irreparable injury unless he shall obtain from your honors the relief hereby sought.

To the end, therefore, that the said defendants may, if they can, show cause why your orator should not have the relief hereby prayed, and may, the said Belknap Mills in their corporate capacity, under their corporate seal, and the said James Bailey upon his oath, and both to the best and utmost of their knowledge, remembrance, information, and belief, full, true, direct, and perfect answer make to all and singular the matters herein charged as fully as if they were thereto particularly interrogated, and especially that they may answer—

1. Whether the said Belknap Mills has not manufactured, or been concerned in manufacturing, and with whom, since the reissue of the said Marshall's patent, and both before and after the granting of said extension, figure or fancy power looms, and how many, of the kind described in said reissue patent, or in what respects differing therefrom, or of any kind in which is combined with the jacks that operate the series of leaves of heddles, and with the lifter and depresser and pattern chain, or some equivalent apparatus for determining the pattern, a mechanism for holding the jacks either in their elevated or depressed position when not required to be operated, and whether such mechanism is not substantially like that used for the same purpose in said Marshall's patent; and, if not, how it differs therefrom.

2. Whether the said Belknap Mills has not now on hand of its own or some other, and whose manufacture, such looms, and how many such as are above inquired of, with intent to sell the same, or deliver them to purchasers thereof.

9 3. Whether the said Belknap Mills has not since the reissue aforesaid sold, or been concerned in selling, to others to be used, such looms as are inquired of, and how many and to whom, and the residences of the parties to whom they respectively sold the same, and at what cost the same were manufactured, and at what prices the same were so sold, and how many and which of such sales were before, and how many and which were after, said extension.

4. Whether the said Belknap Mills has not since the date of said reissue, and both before and after the granting of said extension, used and kept in use figure or fancy looms, and how many such as are above inquired of, and how many yards of goods have been woven on such looms, and at what cost, and at what prices the same have been sold

And that the said Belknap Mills, defendant, may answer the premises, and that they may be decreed to account for and pay over to your orator all such gains and profits as have accrued to them from making, using, or vending the said looms, and that they may be restrained by an injunction, issuing out of this honorable court, from making, using, or vending any one or more of said looms embracing in their construction and mode of operation the invention of said Marshall secured to your orator as aforesaid, and for such other and further relief as the nature of the case may require, and to your honors may seem meet.

May it please your honors to grant unto your orator not only a writ

of injunction conformable to the prayer of this bill, but also a writ of subpœna to be directed to the said Belknap Mills, and to the said James Bailey, commanding them at a certain day, and under a certain pain therein specified, personally to be and appear before your honors in this honorable court, and then and there to answer all and singular the premises, and to stand to, perform, and abide such order and decree therein as to your honors shall seem meet.

And your orator shall ever pray.

GEO. CROMPTON.

CAUSTEN BROWNE, *of Counsel.*

On the first day of October, 1864, before me came George Crompton, to me personally known, complainant in the above-entitled cause, who, being by me duly sworn, did depose and say that he has read the said bill of complaint by him subscribed, and knows the contents thereof, and that the same is true of his own knowledge, except as to the matters which are therein stated on information and belief, and as to those matters he believes it to be true.

In testimony whereof, I have hereunto set my hand and affixed my notarial seal of office this 1st day of October, A. D. 1864.

[L. S.] J. HENRY HILL,
Notary Public.

Whereupon, on the same sixth day of October, A. D. 1864, process is issued against the defendants, as follows:

NEW HAMPSHIRE DISTRICT, *ss:*

The President of the United States of America to the Belknap Mills, a corporation established by law, and located within the district of New Hampshire, & to James Bailey, of Laconia, in said district, superintendent of said corporation, greeting:

[L. S.] For certain causes offered unto our circuit court of the United States, holding pleas in equity within and for said district, in a certain bill in equity filed against you in said court by George Crompton, of Worcester, in the district of Massachusetts, you, & each of you, are hereby strictly required & firmly enjoined that, all business being laid aside, & all excuses ceasing, you do appear before the judges of said court, at the clerk's office at Portsmouth, in the district of New Hampshire, on the first Monday of November next, then & there to answer concerning those things which shall then & there be objected against you, & to do & receive what our judges aforesaid shall have considered in this behalf.

Hereof fail not, on pain of the forfeiture, as well as the consequences that may fall thereon. And have you there this writ.

Witness the Honorable Roger B. Taney, at Portsmouth, the tenth day of October, in the year of our Lord one thousand eight hundred & sixty-four.

ALBERT R. HATCH, *Clerk.*

MEM.—The defendants will take notice that they are to enter their appearance in this suit, in the said clerk's office, on or before the first Monday of November next; otherwise the bill may be taken pro confesso.

ALBERT R. HATCH, *Clerk.*

[Stamp, 50 cts.]

And return is heard of said process as follows:

OCTOBER 13*th*, 1864.

UNITED STATES OF AMERICA, *District of New Hampshire, ss:*
I have this day summoned the within-named corporation, by leaving at the last & usual place of abode of F. W. Reeves, clerk of said corporation, an attested copy of the within writ. I have also made service on the within-named James Baily, by giving to him in hand an attested copy of the within writ.

JONATHAN L. PICKERING,
U. S Dept. Marshal.

11 And on the seventh day of November, A. D. 1864, the defendants enter their appearance in said court, & on the fifth day of December, A. D. 1864, file their answer as follows:

The joint and several answer of the Belknap Mills, a corporation duly established by law, and located within said district of New Hampshire, and of James W. Bailey, of Laconia, in said district, to the bill of complaint of George Crompton, complainant.

These respondents, now and at all times hereafter saving and reserving to themselves all benefit and advantage of exception which can or may be had or taken to the many errors, uncertainties, and other imperfections in said bill of complaint contained, for answer thereunto, or unto so much and such parts thereof as these defendants are advised is or are material or necessary for them to make answer unto, answering, say—

That these respondents have no knowledge whether Moses Marshall, mentioned in said bill of complaint, made any application for letters patent as therein set forth; but these respondents are informed, and believe it to be true, that if said Marshall did make such application, he did not, before said alleged original letters patent set forth in said bill were granted to him, make any oath or affirmation such as was required by law to be made by him before letters patent could be legally granted. These respondents are informed, but have no personal knowledge, that a paper or parchment writing, purporting to be letters patent of the United States, was issued to said Marshall, bearing date on the eleventh day of December, A. D. 1849, and purporting to be signed, countersigned, and sealed, as set forth in said bill of complaint, and purporting to be for an improvement in looms for weaving figured fabrics, whereby there purported to be granted to said Marshall, his heirs, administrators, and assigns, for the term of fourteen years from said last-mentioned date, the exclusive right and liberty of
12 making, constructing, using, and vending to others to be used, said alleged improvements; but these respondents believe that said alleged letters patent, if ever granted or issued, were never legally issued or granted, and were in law a nullity. And these respondents pray that said complainant may be held to prove the legal granting and issuing of said alleged letters patent. And these respondents, further answering, say that they have been informed, but have no personal knowledge whether it be true or not, that a paper or parchment writing, purporting to be a reissue of said alleged letters patent, was granted to said Marshall, purporting to be for said alleged improvement, which said paper or parchment writing purported to bear date on the 24th day of April, A. D. 1860, purported to be signed, countersigned, and

sealed, as alleged in said bill of complaint, and purported to secure to said complainant, his heirs, administrators, or assigns, for the remainder of said term of fourteen years, the exclusive right and liberty of making, constructing, using, and vending to others to be used, said alleged improvement; but whether said alleged reissue was in fact granted, these respondents have no personal knowledge, and pray that said complainant may be held to verify the same, if the same be true; but these respondents are advised and believe that said alleged reissue, if ever granted, was not valid according to law.

And these respondents, further answering, say that they have no knowledge or information, except by said bill of complaint, and cannot set forth as to their belief, or otherwise, whether said alleged original letters patent were inoperative or invalid for the reasons alleged in said bill of complaint, or were surrendered or cancelled, as therein set forth, or whether said alleged reissued letters patent are for the same alleged improvement for which said alleged original letters patent were issued, but pray that the complainant may be held to verify the same if the same be true.

And these respondents, further answering, say that whether said Marshall, at the time alleged by the complainant, or at any other time or times, either by deed or otherwise, in any way assigned, sold, transferred, or set over to said complainant all, or any right, title, or interest in, to, or under said alleged original letters patent, and whether
13 at the time alleged by the complainant, or at any other time, the said Marshall, either by deed, or in any other way, covenanted and agreed to or with the complainant, or his executors, administrators, or assigns, to sell, assign, or convey to him or them all or any right, title, or interest whatsoever in, to, or under any extension or extended term which might be obtained of said alleged letters patent, and whether at the time alleged by the complainant, or at any other time, either upon the petition of said Marshall or otherwise, said alleged reissued letters patent were renewed or extended, as alleged by the complainant, and whether at the time alleged by the complainant, or at any other time, whether by deed or otherwise, said Marshall assigned, sold, or transferred to the complainant, or to his heirs, administrators, or assigns, as alleged by the complainant, all, or any right, title, or interest in, to, or under said alleged extended term, and whether, if any such deed or deeds, or transfer or transfers, was or were made, the same was or were ever duly recorded, or ever recorded as alleged, these respondents have no knowledge or information, except by said bill of complaint, and cannot set forth as to their belief or otherwise, but pray that the complainant may be held to verify the same, if the same be true.

And these respondents, further answering, deny that the said Marshall, from the time of the granting of said alleged original letters patent, up to the time of said alleged assignment to the complainant, and that said complainant since the time of said alleged assignment, either in the exercise of the alleged exclusive right and liberty so alleged to have been granted, or otherwise, made, constructed, used, or vended to others to be used, said alleged improvement, or looms embracing the same, or have ever had or maintained exclusive possession of said alleged improvement or alleged invention. And these respondents, further answering, say that they are informed, and believe and charge it to be true, that said alleged improvement never was of any practical utility, and never went into practical use, but was worthless, and abandoned as such by said Marshall and the complainant.

And these respondents deny that said Marshall was the original and

first inventor or discoverer of said alleged improvement alleged to have been patented in and by said alleged original letters patent, or
14 in and by said alleged reissued letters patent, or of any substantial or material part thereof claimed as new.

And these respondents, further answering, say that they are advised and believe it to be true that said alleged improvement, or a substantial part thereof, was, before the alleged invention or discovery thereof by said Marshall, patented in England by John Mason, of Rochdale, in the county of Lancaster, and George Collier, of Barnsley, in the county of York, by letters patent numbered 12,535, granted by Great Britain to said Mason and Collier, sealed on the 26th day of March, A. D. 1849, the specification whereof was enrolled on the 26th day of September, A. D. 1849.

And these respondents allege and believe that said alleged improvement, alleged to have been patented in and by said alleged reissued letters patent, was, before the time of the alleged invention or discovery thereof by said Marshall, known to and used by said Mason and Collier, and by others in said Rochdale and Barnsley, and in the counties of Lancaster and York, and elsewhere in Great Britain, and by persons in the United States; and that said Marshall, at the time when he made application for the said alleged original letters patent, did not believe himself to be the first inventor or discoverer of said alleged improvement. And these respondents allege and believe that said alleged improvement, before the time of the alleged discovery or invention thereof by said Marshall, was known to and used by Erastus B. Bigelow, of said Boston, and the Lowell Manufacturing Co., of Lowell, Mass., and at said Lowell, and at Clinton, Mass., and was known to and used by Leonard Pierce, of said Lowell, and the Middlesex Mills, of said Lowell, and John Harding, of Harrisville, New Hampshire, and E. A. Winslow, of said Lowell, at said Lowell, and was known to and used by Elisha Allen and Ira Allen, both of Winooski, in the State of Vermont, at Burlington, in the State of Vermont, and was known to and used by Edward Harris, of Woonsocket, Rhode Island, at said Woonsocket, and was known to and used by Samuel T. Thomas, of Laconia, in the State of New Hampshire, at Gray, in the State of Maine, and by Alfred Jenks, Barton H. Jenks, and Joseph G. Mitchell, of Bridesburg and Philadelphia, in the State of Pennsylvania, at said Philadelphia and Bridesburg, and
15 elsewhere in the State of Pennsylvania. And these respondents, further answering, deny that either of these respondents ever, at any time before or since the date of said alleged reissued letters patent, or before or after the alleged extension of said alleged patent, either at Laconia or elsewhere in said district, or at any other place in the United States, manufactured, used, or sold, or continue to manufacture, use, or sell, any loom or looms embracing the said alleged improvement, or any mechanism substantially the same. And these respondents admit that James W. Bailey, one of these respondents, is superintendent of said Belknap Mills, the other respondent, and acquainted with its business.

And in answer to the interrogations to these respondents propounded in said bill of complaint, these respondents says as follows, viz:

To the first interrogatory. That neither of these respondents, neither said Belknap Mills nor said Bailey, has manufactured or been concerned in manufacturing, either before or since said alleged reissue, or before or after the granting of said alleged extension, either alone or with any other person or persons, any loom or looms of the kind described in said alleged reissued letters patent, or of any kind embracing or

containing said alleged improvement, or in which was combined with the jacks that operate the series of leaves of heddles, and with the lifter and depresser and pattern chain, or any equivalent apparatus for determining the pattern, any mechanism substantially like that used for the same purpose in said Marshall's said alleged patent for holding the jacks either in their elevated or depressed position when not required to be operated, but the same was entirely and essentially different therefrom. That there have been manufactured for said Belknap Mills, since the time of said alleged reissue, and both before and since said alleged extension, looms, but the same were all constructed under the letters patent hereinafter mentioned, issued, two of them, to Samuel T. Thomas, and, one of them, to Samuel T. Thomas and Edward Everett, and in conformity to the specifications and drawings thereof, and by authority from the owners of said patents, and were essentially different from the kind referred to in this interrogatory in principle, construction, and mode of operation.

To the second interrogatory. That the said Belknap Mills have on hand in said Laconia, with intent to sell the same, certain looms, but
16 not any of the kind described in said alleged reissued letters patent, or embracing or containing said alleged improvement, or in which is combined with jacks that operate the series of leaves of heddles, and with a lifter and depresser and pattern chain, or equivalent apparatus for determining the pattern, any mechanism substantially like that used in said Marshall's patent for holding the jacks either in their elevated or depressed position when not required to be operated, or anything substantially the same either in principle, construction, or mode of operation, all said looms being constructed under the following letters patent of the United States, and according to and in conformity with the specifications and drawings thereof, and by authority from the owners of said patents, viz: Letters patent to Samuel T. Thomas and Edward Everett for an improvement in pattern cards for Jacquard looms, dated on the 16th day of March, A. D. 1852; letters patent for an improvement in looms granted to said Thomas, dated on the 3d day of July, A. D. 1855; and letters patent for an improvement in fancy looms, granted to said Thomas, dated on the 11th day of February, A. D. 1862.

To the third interrogatory. That said Belknap Mills has sold, since the time of said alleged reissue, certain looms, but not any of the kind described in said alleged reissued letters patent, or any embracing or containing said alleged improvement, or anything substantially the same, either in principle, construction, or mode of operation, but said looms were all constructed, and sold under and by virtue of said patents so granted, two of them to said Thomas, and one to said Thomas and Everett, and under and by virtue of authority from the owners of said patents, and were all constructed according to and in conformity with the specifications and drawings thereto annexed, and were completely successful, and of great practical utility to the community, and looms of that kind have gone into general use.

To the fourth interrogatory. That said Belknap Mills has never at any time used or kept in use any figure or fancy looms such as are inquired about or referred to in this interrogatory. And these respondents, further answering, say that said Belknap Mills were for many years before said alleged assignment to said complainant, and before said alleged reissue, engaged, as said Marshall well knew, in selling looms exactly
17 like those which said corporation now sell, constructed under and according to said patents so granted as aforesaid, two of them to said Thomas, and one of them to said Thomas and Everett.

And said Marshall, well knowing said sales, made no objection thereto, and did not ever pretend or claim that said looms, or the sales thereof, were any infringement of his rights, or contained any invention of his.

And these respondents deny that either the said Belknap Mills, or the said James W. Bailey, have ever violated any rights or privileges of said Marshall, or said complainant.

And these respondents, further answering, say that they are advised and believe it to be true that neither the validity of said alleged original letters patent, nor of said alleged reissued letters patent, has ever been tried either at law or in equity. And these respondents pray that an issue out of chancery may be framed to try at law the validity thereof, or that said complainant may be required, before further proceeding in this cause, to bring his action at law to try the validity of said alleged reissued letters patent.

And these respondents, further answering, say that said letters patent so granted to said Mason and Collier were for certain improvements in machinery, or apparatus for preparing and spinning cotton and other fibrous materials, and also improvements in the preparation of yarns or threads, and in the machinery or apparatus for weaving the same. Without this, that there is any other matter, cause, or thing in said complainant's bill of complaint contained material or necessary for these respondents to make answer unto and not herein and hereby well and sufficiently answered, confessed, traversed, and avoided or denied, is true to the knowledge or belief of these respondents; all which matters and things these respondents are ready and willing to aver, maintain, and prove, as this honorable court shall direct, and humbly pray to be hence dismissed and for their costs.

BELKNAP MILLS,
By JAS. W. BAILEY, *Superintendent.*
R. M. BAILEY, *Treasurer.*
JAS. W. BAILEY.

BROOKS & BALL,
Of Counsel for the Respondents.

18 DECEMBER 2, 1864.

NEW HAMPSHIRE DISTRICT, *ss:*

Then the above-named James W. Bailey and Robert M. Bailey personally appeared, and made solemn oath that the matters and things set forth in the foregoing answer, so far as stated on their personal knowledge, are true, and, so far as stated on information and belief, are verily believed by them to be true.

Before me,

WARREN LOVELL, *U. S. Com'r.*

And on the ninth day of December, A. D. 1864, the complainant files his replication as follows:

The replication of George Crompton, complainant, to the answer of the Belknap Mills and James W. Bailey, respondents.

This repliant, saving and reserving to himself all and all manner of advantage of exception to the manifold insufficiencies of the said answer, for replication thereunto says that he will aver and prove his
19 said bill to be true, certain, and sufficient in law to be answered unto; and that the said answer of the said defendants is uncer-

tain, untrue, and insufficient to be replied unto by this repliant; without this, that any other matter or thing whatsoever in the said answer contained, material or effectual in law to be replied unto, confessed and avoided, traversed or denied, is true; all which matters and things this repliant is and will be ready to aver and prove as this honorable court shall direct, and humbly prays, as in and by his said bill he has already prayed

By his solicitors,

BROWNE AND MAYNADIER.

And this cause is continued in court here, from term to term, until this present term, when the pleadings, proofs, and the arguments
19*a* of counsel having been fully read and heard, it is ordered, adjudged, and decreed by the court here, that the bill of the complainant be dismissed, with costs taxed at
to be paid by the complainant to the defendants.

And now at this same term of said court, to wit, on the first day of July, A. D. 1869, in open court, the said George Crompton comes and claims an appeal from the said order, judgment, and decree of this court at the Supreme Court of the United States, next to be holden at Washington on the first Monday of December next.

And his said appeal is by the court here allowed to him.

And the said complainant files here in court his bond to said defendant, with sureties as follows:

Know all men by these presents, that we, George Crompton, of Worcester, in the district of Massachusetts, as principal, and E. C. Cleveland and Calvin Foster, of said Worcester, as sureties, are held and stand firmly bound unto the Belknap Mills, a corporation duly established under the laws of the State of New Hampshire, and James Bailey, of said State of New Hampshire, superintendand of said corporation, in the full
19*b* sum of one thousand dollars, to be paid to the said Belknap Mills and James Bailey, their certain attorney, executors, administrators, or assigns; to which payment, well and truly to be made, we bind ourselves, our heirs, executors, and administrators, jointly and severally, by these presents. Sealed with our seals, and dated the first day of July, in the year of our Lord one thousand eight hundred and sixty-nine.

Whereas lately, at a circuit court of the United States for the first circuit, within and for the district of New Hampshire, in a suit in equity depending in said court between George Crompton, complainant, and the Belknap Mills and James Bailey, defendant, decree was rendered
19*c* against the said George Crompton; and the said George Crompton having obtained an appeal to remove said cause to the Supreme Court of the United States to reverse the decree in the aforesaid suit: Now, the condition of the above obligation is such that if the said George Crompton shall prosecute his said appeal to effect, and answer all damages and costs if he fail to make his plea good, then the above obligation to be null and void; otherwise to remain in full force and virtue.

GEORGE CROMPTON. [L. S.]
CALVIN FOSTER. [L. S.]
E. C. CLEVELAND. [L. S.]

Signed, sealed, and delivered in presence of—
MARY C. CROMPTON.
ANNA L. FOSTER, *to C. F.*
H. W. WITTER, *to E. C. C.*

19*d* And the same bond is by the said court here approved and allowed.

And thereupon the said Crompton files in court here his bond in the sum of two hundred dollars, with sufficient sureties, unto D. W. Middleton, esquire, clerk of the said Supreme Court, which bond is approved, and transmitted to said Middleton.

Attest: ALBERT R. HATCH,
Clerk of said Cir. Court.

I, Albert R. Hatch, clerk of the circuit court of the United States within and for the district of New Hampshire, do certify that the foregoing, commencing at page five, is a true copy of the original record now remaining in said circuit court, in the above-entitled cause.

In testimony whereof, I have hereunto set my hand and the seal of said circuit court this fifth day of July, A. D. 1869.

[SEAL.] ALBERT R. HATCH.

20 *Complainant's reissue patent.—Reissue No.* 947.

The United States of America to all to whom these letters patent shall come:

Whereas George Crompton, of Worcester, Mass., assignee of Moses Marshall, of Lowell, Mass., has alleged that said Moses Marshall did invent a new and useful improvement in looms for weaving figured fabrics (for which letters patent were issued to said Marshall, dated December 11, 1849, which letters having been surrendered by said Crompton, the same have been cancelled, and new letters ordered to issue to him on an amended specification), which, he stated, had not been known or used before his application, had made oath that he was a citizen of the United States; that he did verily believe that he was the original and first inventor or discoverer of the said improvement; and that the same had not, to the best of his knowledge and belief, been previously known or used; said Crompton having paid into the treasury of the United States the sum of fifteen dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said George Crompton, his heirs, administrators, or assigns, for the term of fourteen years, from the eleventh day of December, one thousand eight hundred and forty-nine, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said
21 Moses Marshall in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

[SEAL OF THE PATENT OFFICE.]

Given under my hand at the city of Washington, this twenty-fourth day of April, in the year of our Lord one thousand eight hundred and sixty, and of the independence of the United States of America the eighty-fourth.

JACOB THOMPSON,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.

S. T. SHUGERT,
Acting Commissioner of Patents.

The schedule referred to in these letters patent and making part of the same.

To all whom it may concern:

Be it known that I, Moses Marshall, of Lowell, in the State of Massachusetts, have invented a new and useful improvement in looms for weaving figured fabrics, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which Fig. I is a front elevation of a loom with the said improvements applied thereto; Fig. II an elevation of one end; Fig. III an elevation of the opposite end, and Fig. IV is a vertical section taken at a plane just in front of the cam-shaft, and parallel with the front of the loom. The same letters indicate like parts in the several figures. My invention relates to improvements in that class of looms for weaving figured and fancy fabrics, in which a series of leaves of heddles are operated by jacks elevated and depressed by a lifter and depresser, as their position is determined to suit the design to be woven by a pattern chain, or any of the known equivalent devices for determining the pattern.

22 And the object of the first part of my invention is, to avoid moving any of the leaves of heddles which are not required to be moved for the production of the design during any part of the operation, so that the movement of the heddles and warps in closing and opening the sheds shall be limited to such of the warps as are at the time actually required for the production of the design or face of the fabric. And to this end this part of the said invention consists in combining with the series of jacks that lift and depress the leaves of heddles with a lifter or depresser for lifting and depressing the jacks, and with a pattern chain, or other equivalent device for placing the jacks in position to be lifted or depressed, a mechanism for holding any of the jacks, either in their elevated and depressed position, when the pattern chain or equivalent device does not indicate that they are required to be shifted for the production of the fabric that is at the time being woven.

And the second part of my invention, which relates to the method of lifting and depressing the jacks by what are known as lifters and depressers, consists in imparting an irregular motion to the lifters and depressers by means of eccentric cog-gearing, so timed, relatively to the motions of the loom, that the lifter and depresser shall move with the greatest velocity at the time the warps are crossing to close a shed and open another, the period of so closing the shed being at or about the time the lay beats up the weft thread, so that the warps shall close upon the weft thread before it is relieved by the back movement of the lay. In this way a much closer fabric can be woven than by crossing the warps as the lay returns. To effect the purpose so indicated, it is important that the heddles should be operated rapidly at the time of beating up the weft thread, as the weft thread should be forced home before the shed closes, and the crossing of the warp should take place during the instant of time that the lay stops to return.

The detailed constructions of the several parts above referred to, and their connected operation, are explained in the sequel, but it will be necessary, in order to avoid confusion, to first refer to the main parts of the loom, which are old and in common use. (*A*), in the several drawings, is the main framework of the machine. (*B*) is the driving shaft. (*C C*) is the warp beam from which the warp threads

23 pass over the smaller roller (*D D*); set just above (*E*) is the lay, with its reed (*F*) and shuttle boxes (*G G*). Over each of the

said boxes is a picker rod (*H H*), on which the pickers (*I I*) slide forward and back to throw the shuttle. (*K K*) are the picker levers or arms which move the pickers; said levers being operated from the cam-shaft (*L*), through the medium of the connecting rods (*M M*) and vertical arms (*N N*) extending up from the cross-shafts (*O O*). These cross-shafts are rocked so as to move the picker arms by means of their bearing plates (*P P*), on which the cams on the shaft (*L*) operate in a manner which is well known to those acquainted with the art of weaving. (*Q Q*), Fig. 1, is the cloth beam on which the fabric is wound during the process of being woven. (*R*) is the shaft which drives the lay by means of the crank rods (*S S*), Figs. 2 and 3. This shaft also operates the apparatus for working the harness, which apparatus I shall now proceed to explain.

The figuring apparatus is mounted in a separate or rather auxiliary frame (*a*), attached to or making part of the main frame of the loom. The series of leaves of heddles of any number desired are stretched between the inner ends of two series of levers (*b*) and (b^1), which vibrate on short cross-shafts (*e*) and (e^1). The shaft (*e*) of the upper series of levers (*b*) is sustained by standards (*f*) of the frame (*a*), and the shaft (e^1) of the lower series is mounted in the lower part of the main frame of the loom. The heddles are connected by reversed oblique cords (*c c*) and plates (*d*) with the upper levers (*b*), and with the lower levers (b^1) by single cords. But the connections may be made in any suitable manner, provided one leaf of heddles be connected with each pair of levers (*b* b^1).

The two series of levers (*b*) and (b^1) are connected at their outer ends by a series of jacks (*g*), one of which is connected by any suitable hinge joint to the outer end of each of the upper levers (*b*), and the lower ends of the jacks are in turn connected by rods (a^1) with the outer ends of the lower levers. The lower levers (b^1) are longer than the upper ones, so that the rods (a^1) that form the connections with the jacks (*g*) are inclined so that the pull on the jacks in operating each leaf of the heddles will tend, by reason of the obliquity of the rod (a^1), to draw its appropriate jack (*g*) outward, for a purpose to be presently described. It will be observed that each leaf of heddles, no matter what the number may be, has its pair of levers (*b* b^1), jack (*g*), and oblique connecting rod (a^1), forming the circuit of connection. The jacks (*g*) are all of them forked at their lower ends, as represented in Figure 4, the two prongs being parallel, and at such distance apart as to admit of the free working of the elevators and depressers (*l k*) between them. These are simply two bars (*l k*) connected with and carried by two parallel chains (*m m*), which pass around rollers on two parallel shafts (*o* o^1), the upper ones of the said rollers being spurred to engage the links of the chains, and the upper rollers (*o*) carries at its outer end a level cog-wheel (d^1), to receive motion from the loom in manner to be presently described. On the inner edge of each prong of the forked jacks there is a shoulder (*h*), the square face of the shoulder being upward on the outer prong, and downward on the inner prong; so that as the lifting and depressing bars (*l k*), carried by the chain (*m m*), or either of them moving down, they will strike on the shoulder (*h*) of the outer prongs of the jacks to depress them, and while moving up they will strike under the shoulder (*h*) of the inner prongs to elevate them; and it will be seen that when any one jack is depressed, the corresponding leaf of heddles will be elevated to carry up that portion of warp threads which it controls, and vice versa; when any one jack is elevated, the corresponding leaf of heddles will be carried down, and with it that portion of the warp which it controls.

24

The distance between the prongs of the jacks is such that the bars (l k) cannot strike the shoulders on the two prongs at the same time; and the tension of the oblique rods (a^1) tends constantly to draw the lower end of the jacks outwards, that the shoulder (h) on the inner prongs may be within reach of the bars (l k) when moving up, that they may be elevated; and this self-same tension tends to keep the shoulder (h) on the outer prongs beyond the reach of the bars (l k) when descending.

These jacks are moved into position to be operated by the lifter or depresser, by the rollers (q^1) acting like cams on what is known as a "pattern chain." These roller cams (q^1) are mounted on rods (p^1), attached to two chains (o^1 o^1), carried by wheels on a horizontal shaft (r^1), turned by a ratchet wheel (s^1), in manner to be presently described, to carry off one set of roller cams, and bring the next into action, as is well known to persons acquainted with this class of looms.

The jacks are slightly curved where the roller cams (q^1) act upon them. Wherever there is a roller cam (q^1) on that one rod (p^1) of the pattern chain which is brought into action, it will act on the jack opposite thereto, and push it inward, so that if it be at the time in an elevated position, the shoulder (h) on its outer prong will be in a position to be acted upon by the depresser bar (l) or (k), by which it will be carried down; but if at such time the jack be in a depressed position, the bars (l k) will not act on it, because the shoulder (h) of the outer prong is as low as the range of action of the bars (l k), and the shoulder (h) of the inner prong is beyond their reach; but such of the jacks as are depressed, and are opposite to a portion of the pattern chain, which for the time being has no roller cam (q^1) on it, will be drawn outward by the tension of the oblique rod (a^1), so that the shoulder (h) of its inner prong will be acted upon by one of its bars (l k), and thereby elevated.

In this way, at each operation, one of the bars (l) or (k) will descend, depressing such of the jacks as have been shifted to come within its range, whilst the other bar will ascend, lifting others of the jacks, thus forming an open shed of such portions of the warp as are controlled by the corresponding leaves of the heddles.

It is important that such portions of the warp threads as are not required to be interwoven during any pick or series of picks should be held in either a depressed or elevated position, as the nature of the fabric may require them to appear either on the upper or the lower surface of the fabric when completed. To accomplish this, there is a mechanism whose sole function is to hold the jacks either in an elevated or depressed position, as the case may be. There is on the outer edge of the two prongs of each jack a shoulder (i i), the reverse of the shoulders (h) on each prong. And there are two series of horizontal spring latches or catches (p) and (q), the series (p) corresponding with the shoulders (i) of the outer prongs of the jacks, and at the required height to hold the jacks in the required elevated position, and the other series (q) corresponding with the shoulders (i) on the inner prongs, and so low as to hold the jacks down to their lowest position. Both series (p q) are beveled on one face like the latch of a door; the shoulders (i i) are beveled in like manner, but on the opposite face. The series of latches (p) are fitted to and are capable of sliding freely in a bar (r) of the frame (a), and the series (q) in like manner in a similar bar (s). The bars (r) and (s) are hollow, and within each is mounted an arbor with a wing (r) which is made to bear, by a spring coiled on the arbor, against a spur on each of the latches. In this way all the latches are held in

their required position, ready to spring back when the level of the shoulders (*i*) of the jacks come in contact when moving in one direction, and to spring out to hold the jacks in position whether elevated or depressed as the case may be; the series (*p*) being to hold them in their elevated position, and the other series (*q*) to hold them in their depressed position. When held in their elevated position, any of the jacks will remain so until they are forced inward by roller cams (q^1) or the pattern chain, which are brought around to act on them, and when any of them are held in the depressed position, they will remain so until some section of the chain without roller cams in it comes opposite to them, and then they will be liberated from the latches by the tension of the oblique rods (a^1) which will draw them outwards, ready to be elevated.

It will be obvious that this part of my invention is not dependent upon the use of a pattern chain, as it can be used in connection with any other device for determining the design to be woven by shifting the jacks, or their equivalent, into position to be elevated or depressed. Nor is it dependent upon the use of chains for carrying the lifting or depressing bars in a continuous circuit, as it is equally applicable to looms in which the jacks are elevated or depressed by the well-known reciprocating lifters and depressers, as in the well-known Crompton loom. Nor is it dependent upon the form of jacks herein described, as these may be greatly varied without departing from the principle or mode of operation resulting from the introduction, in a figuring loom of this class, of a mechanism for holding the jacks, either in an elevated or depressed position, so long as the design of the fabric does not require them to be shifted. And although but one mode of applying this part of the said invention is herein described, like all other inventions, the mode
27 of application may be greatly varied without departing from the principle or mode of operation which distinguishes it from all other things before known.

The level wheel (d^1) in the shaft (*o*), which gives motion to the elevator and depresser bars (*l k*), receives motion from a bevel wheel (e^1) on a vertical shaft, which in turn carries another bevel wheel (f^1) that receives motion from a corresponding bevel wheel (g^1) on a horizontal shaft, which carries an eccentric spur wheel (h^1) that receives motion by an intermediate eccentric wheel (i^1) from another eccentric wheel (k^1) on the shaft (*k*), this latter shaft deriving motion from the cam-shaft (*L*) by cog-wheels (m^1 n^1) at the opposite side of the loom. The object of this eccentric gearing is, to give a varying motion to the lifter and depresser bars (*l k*), so that in shedding the warps the motion shall be quickest when the descending and ascending warps cross each other, and this, as represented, takes place just as the lay beats up the weft, so that the warps shall close it in before the reed leaves it. By means of this a much closer fabric can be woven than if the lay is permitted to move back before the crossing of the warps.

The pattern chain, as it is termed, is composed of two endless chains (o^1 o^1), between which are stretched the cross-rods (p^1 p^1 p^1), on which the circular cams or rollers (q^1 q^1 q^1) are arranged with interposed washers, so that they can be shifted along on said rods, to vary the pattern, by operating on different jacks against which they press. This pattern chain, with its rollers and rods, is hung over and is turned with the shaft (r^1 r^1), Fig. 2, which shaft is revolved by means of a ratchet-wheel (s^1) on one end of said shaft, operated by the catch (t^1), said catch being moved by a crank-rod (u^1 w^1) shown by dotted lines in Fig. 4. One end of this crank works in a slot of one arm of a right-angular lever (v^1 v^1), to the other arm of which the catch (t^1) is connected, as shown by dotted lines

in said Fig. 4. The other end of the crank-rod is connected eccentrically to the face of the gear-wheel (W^1), which receives motion from the gear-wheel (x) on the upper shaft ($o\ o$), which carries the lifter and depresser bars ($l\ k$), as hereinabove explained. The motions of the pattern chain are regulated by the notched wheel (y^1) on the front end of the shaft ($r^1\ r^1$) and spring pawl (z^1), arranged as shown clearly in Fig. 1.

It now only remains to describe the "evener," as it is termed,
28 which works with the heddle or harness levers, so as to assist in shifting the sheds, and to keep said levers in accurate position for the operation of the cam.

This "evener" consists of two rollers ($a^2\ b^2$), which are set and have bearings on the forked ends ($c^2\ d^2$) of two horizontal bars ($e^2\ e^2$), said bars being arranged so as to move forward and back in proper guides or holes formed in the upright and curved supports ($f^2\ g^2$) attached to the top of the framework (a). These rollers press against the outer ends of the upper harness levers ($b\ b$), which are beveled for the purpose, as shown in Fig. 1 and Fig. 4, and, as will be obvious, serve the purpose as hereinafter suggested. A reciprocating rectilinear motion is imparted to this "evener" by means of the crank-arms ($h^2\ h^2$) on opposite ends of the shaft ($i^2\ i^2$), having proper bearings depending from the framework (a), said crank-arms being attached to one end of the connecting rods ($k^2\ k^2$), the other ends of which rods are connected to the sliding bars ($e^2\ e^2$), as shown in Fig. 1. The shaft (i^2) is vibrated or rocked so as to give the requisite motion to the "evener," through the medium of the several parts arranged or connected, as above described, by means of the crank-arm (l^2) and connecting rod (m^2), the lower end of which is attached eccentrically to the middle wheel (i^1) of the eccentric gears, hereinbefore referred to in the machinery for driving the jacks.

What I claim as my invention, and desire to secure by letters patent, is, combining with the jacks that operate the series of leaves of heddles, and with the lifter, and depresser, and pattern chain, or any equivalent apparatus for determining the pattern, a mechanism for holding the jacks either in their elevated or depressed position, when not required to be operated substantially as and for the purpose specified.

I also claim imparting an irregular motion, substantially such as herein described, to the jacks, by means of eccentric cog-wheels, substantially as and for the purpose specified.

MOSES MARSHALL.

Witnesses:
DAVID LANE.
WARREN ALDRICH.

29 TESTIMONY FOR COMPLAINANT.

Deposition of Henry B. Renwick, taken before N. Austin Parks, examiner, July 21, 1866.

Int. 1. State your name, age, residence, and occupation.

Ans. Henry B. Renwick; age, 48; residence, New York, N. Y.; occupation, civil and mechanical engineer.

Int. 2. State briefly what experience you have had in the examination and comparison of machinery upon questions of their substantial identity or difference.

Ans. I have been engaged more or less for the last thirteen years in making such examinations of machinery, chiefly with a view of giving opinions in patent suits.

Int. 3. Have you examined the reissued letters patent, dated April 24, 1860, granted to the complainant George Crompton, as assignee of Moses Marshall, the alleged inventor, for improvement in looms for weaving figured fabrics; and do you understand the construction and mode of operation of the mechanism there shown?

Ans. I have frequently examined the patent, and believe I understand the construction and operation of the machinery therein described.

Int. 4. Will you describe generally the combination of mechanism and its operation by which the shed is formed and shifted in the loom there described and represented?

Ans. The shed formed by the loom is of a peculiar character in this respect; namely, that the leaves of heddles, controlling warp threads that are to be kept elevated or depressed during any number of picks more than one, are not returned at each pick to the mean line of the warp thread, but are held elevated or depressed by proper mechanism as long as the exigencies of the pattern to be woven may require.

30 The mechanism for shifting and forming this peculiar shed consists of the leaves of heddles, of proper mechanism for connecting the leaves with the jacks, of the jacks themselves so connected to the heddles that when the jacks are moved the heddles are moved, of a pattern barrel or a pattern chain which selects the jacks that are to be [be] moved, of lifters and depressers which move the jacks when they are thus selected, and of a holding mechanism for retaining the jacks, and, consequently, the leaves in an elevated or depressed position for the length of time required by the pattern to be woven. In the patent it is stated in substance that other devices than pattern chains may be employed for selecting the jacks, and that other forms of lifters and depressers, and holding mechanism, and other forms of jacks may be used. But whatever lifters and depressers are used must have the peculiar mode of operation represented in the patent; that is, they must move through a sufficient distance to carry the leaves from a completely elevated to a completely depressed position, in which respect they differ from the elevators and depressers that I know of used prior to Marshall's invention. The precise pattern chain, represented in the drawings of the patent, is one which has rotary motion only. The precise jacks represented in the drawings of the patent are forked jacks, and the holding mechanism specially described and represented in the drawings are two series of spring latches, one for each jack in each series. The operation of these parts, in brief, is that the pattern chain selects the jacks, that the jacks are then either elevated or depressed by the lifters and depressers, carrying the heddles with them, and thus forming the shed, and that all the jacks, and, consequently, the leaves of heddles are then held fast in their elevated or depressed positions by means of the holding mechanism, thus holding the shed open until the pattern requires leaves of heddles to move from the elevated to the depressed position, or vice versa. Such leaves as the pattern may then require to be moved are again selected by the action of the pattern chain; and, by means of a mechanism before described, are shifted from the highest to the lowest position, or vice versa, and when thus shifted are again locked fast, as before stated.

Int 5. Will you look at model marked "Complainant A., N. A. P., Ex'r," and state whether it is constructed in accordance with the speci-

31 fication and drawings of the Marshall reissue patent just referred to?

Ans. It is.

Int. 6. Have you examined a copy of letters patent granted to Sam-

uel T. Thomas, February 11, 1862, for an improvement in fancy looms, and will you produce a model constructed in accordance with the specifications and drawings thereof?

Ans. I have, and the model marked "Complainant B., N. A. P., Ex'r," is a correct representation of the loom described and represented therein, except in two particulars. In the drawings of the patent the jacks are represented as thrown outwards by spiral springs; in the model they are thrown outward by weights. In the model there is a series of friction brakes pressed upon the sectors by springs and pressure screws, whereas in the description of the patent there is no mention of any brake, and I am not able to state with certainty whether the parts marked *r* and *q*, in this drawing, are or are not intended to represent a series of brakes and springs.

Int. 7. Have you examined letters patent granted to Samuel T. Thomas, July 3, 1855, for an improvement in looms; and, if yea, will you state what that patent shows in respect to the brakes and their springs mentioned in your last answer?

Ans. I have examined it, and there is no reference in the description to any brakes for the series of sectors; but in the drawing, at Fig. 6, there is represented what is obviously a spring brake and a temper screw, the former bearing upon one or more of the series of sectors. In Fig. 1 there is a representation showing that there is one of these breaks for each sector of the series.

Int. 8. Will you describe generally the combination of mechanism and its operation by which the shed is formed and shifted in the loom represented by the model "Complainant B?"

Ans. In this model there are a series of leaves of heddles connected with the jacks in such manner that a motion of the jacks causes a movement of the leaves of heddles, the connection between the jacks and the heddles being composed of racks on the jacks, cog sectors, slots in those sectors, a series of friction rollers or pins playing in the slots, a series of jack-levers to which the pins are attached, and a series of cords and pulleys which cause the vibration of the levers to shift the leaves
32 up and down. In this loom, also, there is a pattern chain which selects the jacks, and, consequently, the heddles that are to be elevated or depressed according to the exigencies of the pattern, and elevators and depressors with sufficient range of motion to move the jacks, and, consequently, the heddles from a completely elevated to a completely depressed position, and vice versa. In this model there is a holding mechanism which operates to hold locked, in an elevated or depressed position, all the jacks and consequently the heddles, whether elevated or depressed, in such elevated and depressed position, until the exigencies of the pattern require that one or more leaves of heddles shall be moved from an elevated to a depressed position, or vice versa, thus forming an open shed.

Int. 9. In your opinion, is the combination of mechanism for the purpose of forming and shifting the shed, shown in model "Compl't B," substantially similar to, or substantially different from, the combination of mechanism for the same purpose shown in the Marshall reissue, before referred to? And give your reasons for your opinion.

Ans. It is substantially the same. My reasons for that opinion are, that I find in both a series of leaves of heddles, a series of jacks so connected thereto that a movement applied to the jacks moves the heddles; and in both I find elevators and depressers, with a range of motion sufficient to move the heddles from a completely elevated to a completely depressed position, and vice versa; and in both I find a pattern chain

acting to select the jacks, and, consequently, the heddles that are to be elevated or depressed—all these parts being substantially the same, and operating in substantially the same manner to produce the same results in both the description of the patent and in the model "B." In both patent and model there is a holding mechanism for holding both the jacks and the heddles in elevated or depressed positions, as long as the exigency of the pattern may require. The specially described mechanism of the patent is, as I before stated, two series of locking latches, one in each series for each jack. In the defendant's loom I also find two series of locking latches, one in each series for each jack, these locking latches in Model "B" being the concentric portions of each slot in each sector, and at each end of the slots. In Model "B" the slots in the sectors, taken as a whole, perform two entirely distinct and independent functions. The function of the eccentric part of the slot
33 is to vibrate the jack-levers and consequently elevate or depress the heddles, and the function of the concentric parts of the slot is by acting upon the pin to lock the jack, and consequently the heddles, in either elevated or depressed positions, as the exigency of the pattern may require. The concentric or locking part of the slot does not commence to lock the heddles in position until the eccentric parts of the slot have lifted or depressed them, and the operation would be precisely the same if the eccentric portions of the slots were cut in one series of sectors, and the concentric portions in another and different series of sectors. In the model "B" I find applied to each of the sectors a brake, the object of that brake being to prevent the locking notches of the sectors from being jarred out of their locking position by the vibration of the whole frame of the loom or of the building in which it is placed—these brakes operating in connection with the locking notches in the same manner as a pressure spring upon an ordinary door-lock bolt. I find, therefore, in both the patent and in the model two series of locking devices, acting in substantially the same manner, to hold the jacks in an elevated or depressed position for the same purpose; and I find, both in the patent and in the model, substantially this same combination of substantially the same devices for forming and shifting the shed.

And in answer to cross-interrogatories, propounded to him by George Gifford, esq., of counsel for respondent, deponent saith as follows:

Cross-int. 1. Answer the last question, supposing the brakes to be removed from model "Compl't B."

Ans. I answer it in the same way, leaving out all reference to the brakes.

Cross-int. 2. Then you mean to give it as your opinion, do you, that the combination of mechanism for the purpose of forming and shifting the shed, as shown in model "Compl't B," supposing the brakes to be removed therefrom, would still be substantially the same as the combination of mechanism for the same purpose shown in the Marshall reissue before referred to?

Ans. I do.

Cross-int. 3. Do you assume that the spring catches described
34 in the Marshall reissue form a part of the combination of mechanism for the same purpose of forming and shifting the shed?

Ans. I do.

Cross-int. 4. What do these spring catches do in forming and shifting the shed?

Ans. After one shed has been formed, and after the first pick of the loom, they hold in elevated or depressed positions such leaves of heddles as are already elevated or depressed, and may be required to re-

main in an elevated or depressed position at the second pick of the loom.

Cross-int. 5. When one of those spring catches commences to hold the heddle in an elevated position, has not the shed then been formed by the elevation of such heddle?

Ans. It has for the next pick.

Cross-int. 6. When one of those spring catches commences to hold a heddle in its depressed position, has not the shed then been formed by the depression of such heddles and the elevation of the others?

Ans. It has for the next pick.

Cross-int. 7. If then the sheds are formed and shifted by simply the elevation and depression of the heddles, how can you say that the spring catches, employed merely to hold the heddles in such elevated or depressed position, constitute a part of the mechanism employed in forming and shifting the sheds?

Ans. Because whenever a leaf of heddle is required to remain up or down for more than one pick, then the locking mechanism holds them up or down for as many picks as may be required, and thus at one pick aids in forming the shed for several succeeding picks.

Cross-int. 8. Does it aid in forming it, or hold it already formed?

Ans. It does not hold it already formed, because the shed, as a whole, is formed partly out of leaves held in position by the locks, and partly out of leaves whose positions have just been reversed by the action of the jacks. It does truly hold a part of the shed already formed.

Cross-int. 9. I see in the Marshall reissue above-mentioned a reference to what is therein called "the well-known Crompton loom." Are you acquainted with that Crompton loom?

35 Ans. I am, by examination of a model said to be made like such loom.

Cross-int. 10. Which of the parts enumerated in your answer to 9th interrogatory-in-chief do you find in that Crompton loom?

Ans. All the parts except the locking mechanism, and all the same in operation except the lifters and depressers.

Cross-int. 11. Do you consider that there is a substantial difference between the lifters and depressers employed in that Crompton loom and those described in the Marshall reissue?

Ans. None in their construction nor in their connection with the heddles, and none in their mode of operation, except that in the Crompton loom the lifters and depressers have such a range of motion as compared with the ultimate range of motion of the heddle leaves that the latter are only moved through half their range of motion by any one stroke of the lifter or depresser; whereas in Marshall's patent and loom "B," the lifters and depressers have such a range of motion, as compared with that of the leaves, that the latter can be moved from a completely elevated to a completely depressed position, or vice versa, by a single stroke of either elevator or depresser.

Cross-int. 12. In your examination-in-chief you say that the shed formed by the mechanism described in the Marshall reissue is of a peculiar character. Do you then refer to the character of the shed or to the manner of forming it?

Ans. If the shed is considered to last during only one pick of the loom, I refer to the manner of forming it; but if the word "shed" is considered as being applied to several picks of the loom, I then refer to the character of the shed.

Cross-int. 13. How does the continuation of a shed after it is formed change its character?

Ans. Because in the "Marshall" loom and in loom "B," many warp threads which have been elevated and depressed for one shot of the shuttle are retained, elevated or depressed, and without being moved from their position during several succeeding shots of the shuttle, so that a portion of the shed is at all times open in these looms; whereas in former looms having leaves of heddles and pattern chains and elevaters and depressers, the warp threads were returned from their
36 elevated and depressed to the mean positions of the thread at each shot of the shuttle. This latter was the operation and character of the shed in the Crompton loom.

Cross-int. 14. Is or not a shed formed by the old Crompton loom of the same "character" as a shed formed by the Marshall mechanism; and can or cannot as many kinds of sheds be formed by the old Crompton loom as by the Marshall mechanism?

Ans. If you use the word "shed" as defining that position of the warp thread which exists at the time of the throwing of the shuttle, then the sheds are of the same character in both; but if it be used in the sense of defining the position of the warp thread that exists during several picks, then their characters are different, and in the Crompton loom there never exists such a relative position of the warp thread as at times exists in Marshall's loom and loom "B," where certain warp threads are held elevated and depressed, thus keeping a portion of the shed open whilst others of the warp threads are being either elevated or depressed. Supposing the pattern chain, &c., to be the same in the Crompton, the Marshall, and loom Model "B," the same variety of figuring of the stuff woven may be made in all three.

Cross int. 15. Cannot as many kinds of sheds be formed with all three, and does not the difference which you have spoken of simply exist or occur while forming the shed?

Ans. As I have before stated, I do not think that the same kind of shed can be formed in all three, and there is a difference between the shed itself and the manner of forming it, as I use the word, between the Crompton loom on the one side, and the Marshall loom and loom "B" on the other.

Cross-int. 16. In the sense in which you have used the word in giving your last three or four answers, have you not called a condition of the warp threads a shed, which condition preceded the formation of a shed ready for the shot of the shuttle?

Ans. I have at times, because both in the Marshall loom and in loom "B" certain portions of the shed are open and formed, and so held, prior to the movement of the other portions of the warp thread to complete the shed for the next succeeding pick of the shuttle.

Cross-int. 17. Do you find in the Marshall reissue a sector described?

37 Ans. I do not.

Cross-int. 18. Do you think you find any equivalent for a sector in the Marshall reissue?

Ans. Considered by itself, I do not; but the sector is a part of a train of mechanism which transmits the motion of the jacks to the heddle, and in Marshall's I find a train of mechanism which transmits the motion of the jacks to the heddles.

Cross-int. 19. Then do you think that because each of two trains of mechanism transmits motion from a certain point or place to another point or place, they are substantially the same, or equivalents of each other?

Ans. Not necessarily so.

Cross-int. 20. Is not motion in the old Crompton loom communicated from the jacks to the heddles?

Ans. It is.

Cross-int. 21. Could you operate a loom by placing an elastic friction pad in place of the spring catches in the Marshall reissue, having the friction pad to press continuously sufficiently against the jacks to retain them in their elevated and depressed positions, do you think?

Ans. I cannot answer that question satisfactorily to myself, or, I think, to any one else, without seeing either a model or drawing of the contrivance intended to be applied to perform the duty of Marshall's latches. My impression is, if I have a right idea of the supposed machine that you speak of, that it might perhaps be made to operate, but not to operate in such a way as to produce any good practical result.

Cross-int. 22 If we were to take such a loom as is described in the Marshall reissue, and substitute such spring-pressure pad for the spring catches, and the loom should successfully operate, would the use of it, according to your judgment, employ what is specified in the Marshall reissue as his invention?

Ans. I can't tell you till you show me the loom.

Cross-int. 23. Can't you predicate an answer on a supposed arrangement of the loom?

Ans. Probably yes, if you describe the loom so clearly that I can build one from your description.

38 Cross-int. 24. Do you think Marshall, in his reissue, has sufficiently described the loom to enable you to build it?

Ans. I do, by the aid of the drawings making part of the descriptions.

Cross-int. 25. Take the loom as described by him—remove the shoulders from the jacks, which shoulders are to act upon the spring catches; remove also the spring catches; substitute instead of the spring catches a series of pressure pads so pressing continuously upon the jacks as to hold the jacks in any positions where the lifter and depresser might leave them, would not such a loom include substantially what is specified in the first claim of said reissue patent as the invention of the patentee?

Ans. I don't believe such a loom would work at all, and therefore can't give any opinion about it.

Cross-int. 26. Then you are unable to give an opinion because you don't believe it would work, are you?

Ans. That is the reason. My mind is not of a character to make close comparisons between operative and inoperative structures.

Cross-int. 27. Now, suppose such a loom would operate successfully, and give an opinion.

Ans. I can't make that supposition.

Cross-int. 28. Are we to understand from your examination-in-chief, and particularly from your answer to the last interrogatory of that examination, that you are of the opinion that there is anything specified as the invention of the patentee in the Marshall reissue patent which is employed in the model "Compl't B," or represented therein? If yea, explain what it is.

(Objected to.)

Ans. I am of opinion that there is in the loom, Model "B," what is specified as of Marshall's invention in that reissue, namely, the combination of the jacks, leaves of heddles, the elevators and depressers, the pattern chain, and the mechanism for holding the jacks either in their elevated or depressed positions.

Cross-int. 29. You mentioned in your examination-in-chief that the patentee, Marshall, states that he does not limit himself to the jacks

specially described. Can you think of any jack that will not come within the form of jack which he includes in that patent?

39 Ans. At present I cannot; provided it operates in substantially the same way as that described in the patent.

Cross-int. 30. What jack would operate in substantially a different way—if you know of any?

Ans. Any jack that was the same as Marshall's that hadn't the proper machinery to move it, or was not properly connected with the heddles, or was not properly combined with the pattern chain.

Cross-int. 31. Please describe such a jack, and its connection and combination with the other parts as you have referred to in your last answer, sufficiently in detail to enable a machinist to construct it.

Ans. A jack exactly like Marshall's, so connected wth the leaves of heddles that it wouldn't move them far enough to open the shed, situated in such relation to the elevators and depressers that only one of them could operate upon it, and so far removed from the pattern chain that the latter could not affect its position.

Adjourned to July 19, at 9½ o'clock.

JULY 19.

Cross-int. 32. Do you mean to be understood as testifying that the pattern chain and the mechanism, for combining it with the jacks, are substantially the same as represented in model "Compl't B," as they are described in said Marshall reissue?

Ans. I think that the pattern chain in Model "B" is, considered by itself, a substantially different species of pattern chain from that specially described and represented in the drawing of the Marshall reissue, and differing from it in the fact that it requires motion in two directions, in order to cause it to operate upon the jacks, while the chain represented in the drawings of Marshall requires motion only in one direction. Both of them, however, are old and well-known forms of pattern chains. In the use of the chain specially represented in the Marshall drawing, the roller cams act directly upon the jacks. The chain in Model "B" acts upon the jacks through the intervention of bent weighted levers, and in that respect there is a difference in the mechanism connecting the jacks with the chain in the two looms. The substitution of the peculiar chain used in Model "B" in place of that

40 represented in the drawings of Marshall renders these levers necessary. But in both looms the pattern chains act to move the jacks in one direction, and to permit them to be moved in the other. Both chains being well known as substitutes for one another, and both having the same ultimate action upon the jacks for the same purpose, I consider the combination of the jacks and pattern chain to be substantially the same in the Marshall reissue and in Model "B."

Cross-int. 33. Do you or do you not consider the mechanism by which the chain is combined with the jacks in Model "B" substantially the same as the mechanism (if there is any) by which the chain is combined with the jacks in said Marshall reissue?

Ans. I have already stated that the mechanism by which the motions of the chain are communicated to the jacks in Model "B," and this is what I suppose you mean by the words "mechanism by which the chain is combined with the jacks," does not exist in the precise mechanism represented in the drawings and specially described in the Marshall patent. It follows from that, that in the Marshall drawings there is no mechanism like, or substantially like, or performing the precise office of, the bent connecting levers of Model "B."

Cross-int. 34. What motion of the chain is communicated to the jacks in Model "B?"

Ans. The motion of the axis of the chain barrel in a perpendicular plane.

Cross-int. 35. Do you mean to be understood as saying that the chain exerts any force upon the jacks in Model "B?"

Ans. It does, by removing the weight of the forward bent lever, and permitting the rear bent lever to throw the jack in position. If the chain did not exert sufficient force to move the forward lever, the jack would remain at rest.

Cross-int. 36. By what force are the jacks in Model "B" moved back and forth to connect and disconnect with the elevators and depressers?

Ans. The jacks are moved forward as stated in my last answer; and are moved backward by the preponderating weight of the front series of weighted levers, when the chain permits those front levers to drop.

41 Cross-int. 37. What is the force which moves the jacks forward in Model "B?"

Ans. The weight of the hindmost series of levers, when they are permitted to act by reason of the chain lifting the first series of levers, and as the chain lifts the first series of levers, doing a certain amount of work, and as the weight thus lifted, when it falls, shifts the levers, or the lifting of that weight permits the levers to be shifted in the other direction, the chain furnishes the force to shift the jacks.

Cross-int. 38. Is it not the weight of the back levers, together with the weight of the jacks themselves, which moves the jacks forward?

Ans. Yes; looking at no further mechanism than that; but as the chain must lift the heavy front levers before the hindmost series can act at all, and must restore them to their highest position after they are fallen, thus lifting their weight, the chain is really the instrument that furnishes the force.

Cross-int. 39. Is it not really the weight of the front levers which moves the jacks back?

Ans. Yes; after the chain has lifted the weight which in falling shifts the jack, the chain in this case also really furnishing the power to shift them.

Cross-int. 40. Is it not the weight of the front levers which lifts the back levers in Model "B?"

Ans. It is the falling of the weight of the front levers after they have been lifted by the chain.

Cross-int. 41. What are the motions of the pattern chain in Model "B," as you understand it?

Ans. Up and down as a whole in a vertical plane, passing through the axis of the chain barrel, and round and round in an irregular curve, owing to the revolution of the chain barrel on its axis.

Cross-int. 42. By which of those motions does the chain lift the front levers?

Ans. By the motion in a perpendicular plane passing through the axis of the barrel, as I have before stated.

Cross-int. 43. What are the motions of the pattern chain in said Marshall reissue?

42 Ans. The chain specially described and represented in the drawings moves round and round in an irregular curve, part of which is an arc of a circle.

Cross-int. 44. By what force are the jacks moved back and forth to connect and disconnect them with the elevator and depresser in said Marshall reissue?

Ans. By the force of the chain, whose roller cams act directly upon the jacks to force them in one direction against a spring pressure, and permit that spring pressure to return the jacks in the other direction.

Cross-int. 45. When did you first see such a chain as is employed in model Exhibit "B?"

Ans. As far as it is a chain constructed with the particular little doors in it to shut the holes, thus making the same chain available for several different patterns, my impression is that I have not seen it earlier than four or five years back. As far as it is a chain, having the motion which I have described it as having, and having holes and blank spaces directing the selection of the jacks, I have known it for many years; if my memory serves me rightly, more than twenty.

Cross-int. 46. Do you mean to be understood as saying that you have known the chain, without the little doors referred to, which moved up and down and was employed to select jacks, for more than twenty years? If yea, specify in what loom or machinery, and where.

Ans. I am unable to say whether, at the earliest time I had knowledge of that chain, it had a rotary and up-and-down motion, or a rotary and horizontal motion, and I am unable to remember whether the chains that I saw at that time selected jacks or some other mechanical means of shifting warp threads. I saw it at that time described and represented in books, what ones I am unable to say, but I think it was in some book of Dr. Lardner's.

Cross-int. 47. Are the little doors you speak of in the pattern chain of Model "B" employed in lifting the front levers?

Ans. They form, when shut, the solid part of the chain that lifts the front levers.

Cross-int. 48. Question repeated.

Ans. They are, when shut, moved upward by the chain, of which they make a part, being interposed between the looms and the other
43 parts of the chain, so that the doors strike against the pins depending from the levers, and by the force of the chain, as a whole, lift the pins which lift the levers, the pins and the doors being interposed between the levers and the chain, and being employed in lifting by reason of such interposition, if that is what you mean by being "employed."

Cross-int. 49. In giving your answers in your direct examination, to what extent did you assume that the pattern mechanism in the loom described in said Marshall reissue might be changed and still be within said patent?

Ans. It might be changed by the substitution, for the precise mechanism described, of any proper device substantially the equivalent thereof and acting in substantially the same way in the combination, or by the substitution of any well-known mechanical substitute employed for similar purposes in mechanical structures, and having substantially the same mode of operation in the combination.

Cross-int. 50. Did you not assume that every pattern mechanism is comprehended in the patent which would select jacks for the purpose of moving the proper heddles to weave a fabric of a given figure? And if you did not, describe such of them as you excluded.

Ans. I did not make any such assumption, and I did not pick out any pattern mechanism in my mind to exclude.

Cross-int. 51. Did you not, in giving your answers, or some of them, in your direct examination, have any reference to the following language in said reissue: "It will be obvious that this part of my invention is not dependent upon the use of a pattern chain, as it can be used in connection with any other device for determining the design to be woven,

substantially different in the models "A" and "B," and will you give your reasons for your opinion?

Ans. As I have before stated, I consider the chains per se different, and know of cases in which the chain of Model "A" would be
47 useless as a selecting mechanism. But so far as the chains in both models operate by means of protuberances and depressions (and I think that the chain in Model "B" would have protuberances and depressions, if each leaf were only a flat plate with holes in it), to select which jacks shall be kept up or down, and which jacks shall be moved up or down at each pick, I consider them substantially the same in their combination with the jacks, and consequently with the heddles. In both there must be a repetition of protuberances as long as the leaf of heddles answering thereto is to be kept up, and in both a repetition of depressions as long as the leaf of heddles answering thereto is to be kept down. And I should consider them still the same, even if the depressions dictated heddles to be kept down in one model and elevated in the other.

HENRY B. RENWICK.

Deposition of Hervey Waters, taken before N. Austin Parks, examiner.

THURSDAY, *July* 19.

Int. 1. State your name, age, residence, and occupation.

Ans. Hervey Waters; age, 62 years; residence, Boston, Mass.; occupation, machinist.

Int. 2. Have you heretofore frequently acted as consulting expert, and as expert witness in patent causes on mechanical questions?

Ans. I have.

Int. 3. Have you had, in time past, means of becoming acquainted, practically as well as theoretically, with the general subject of looms for weaving? And, if yea, state briefly what your means of such knowledge have been.

Ans. I have had some practical experience with looms in early life, so far as goes to the use of plain and twilled looms, having constructed such and run them personally. I have never had practical experience
48 with either fancy looms or figured looms, but have had occasion to inquire somewhat fully into the structure of both those kinds of looms in my experience as an expert.

Int. 4. Have you examined the model marked "Complainant A," testified to by Mr. H. B. Renwick, as being made according to the description and drawings of the reissue patent granted, April 24th, 1860, to the complainant, George Crompton, as assignee of Moses Marshall, the alleged inventor, for improvement in looms for weaving figured fabrics, and do you understand the construction and mode of operation of the mechanism there represented?

Ans. I have examined the model, and believe I understand its operation and construction.

Int. 5. Will you describe generally the combination of mechanism, and its operation, by which the shed is formed and shifted in the loom there represented?

Ans. This contrivance belongs to the class of looms which I call "fancy looms," and which lies between what I call "twilled looms" on the one side and "figured looms" on the other. These fancy looms I understand as always carrying leaves of harness instead of single heddles of harness, as in the figured looms. These leaves of harness are elevated and depressed positively by what are termed elevators and

depressers. These elevators and depressers operate on the jacks, from which and through which motion is communicated to the leaves of harness, for the purpose of producing the shed—that is, for opening the web for the passage of the shuttle through it. These lifters and depressers serve in common to all the jacks; consequently, to all the leaves of harness. But the peculiar jacks, which, for the time being, may be required to act to produce the figure of the piece, are indicated by a pattern chain, the pattern chain being the principal instrument or device for determining the figure. There is, also, entering into this combination, two series of latches; one series for holding the jacks in position for the elevated harness; the other series holding the jacks in position for the depressed harness; constituting this loom an open shed fancy loom, in contradistinction to such fancy looms as went before it, so far as I know, where the shed was not so held open, but, on the contrary, the shed was closed at every throw of the shuttle. These latches come into position by means of a spring, so as to engage with the jacks;
49 but the jacks are released from the catches by the action of the pattern cylinder, when the exigencies of the figure require a change in the shed. Another difference between this and such fancy looms as I have known before it, and necessary to its being an open shed loom, is that the lifters and depressers travel the entire distance necessary to carry the warp thread to the full extent from side to side of the shed, while in the other fancy looms they travel but about half as far.

Int. 6. In order to give a clearer notion of the distinctive character of the loom represented by the model "A," taken as a whole, will you please to compare it with any loom known to you as existing before the time of the Marshall loom—in which prior loom leaves of heddles were used, and the warps were detained in their elevated or depressed position until required to be shifted in the progress of weaving in the loom? And state generally the differences, if any, between the characteristics of such two looms.

Ans. I do not now recollect of any loom, using leaves of harness only for the figure, which made an open shed. The only looms which I now remember making such a shed are the plain loom and the twilled loom, in both of which the changes were made with cams, using no lifter and depresser, and no pattern chain. These twilled looms were sometime made so that the cams worked the harness positively in both directions, and sometimes worked the harness in one direction by cams, the harness being carried in the other direction by means of weights or sinkers, never using a lifter and depresser strictly as such. None of those looms made figures, but they made a twill where the change at each successive pick was uniform. I believe there have been figured looms using both leaves and independent heddles, but I do not now recollect distinctly their construction, and am not able to say whether they used an open shed or otherwise.

Int. 7. Have you examined model marked "Complainant B," and—(Defendants admit that complainant's model "B" correctly represents the mechanism employed in the looms used by the Belknap Mills, after the complainant's reissue and before the filing of the bill of complaint in this cause, so far as it purports to represent such mechanism. N. A. Parks, Ex'r)—do you understand the construction and mode of operation of the mechanism there shown?

50 Ans. I have examined the model, and believe I understand the same.

Int. 8. Will you describe generally the combination of mechanism and its operation, by which the shed is formed and shifted in the loom

represented by that model, so far as they differ from the combination and operation of the mechanism for that purpose shown in the model "A," and state whether, in your opinion, the combination of mechanism for that purpose is substantially the same or substantially different in the two looms?

Ans. This contrivance, shown in Model "B," is for the same general purpose as the contrivance represented in Model "A"; that is, it is an open shed fancy loom containing, in its combination, jacks, lifters, and depressers, a pattern chain and a device for detaining the jacks at the end of their extreme movement in both directions. In detail it differs from Model "A." The pattern chain is different specifically, and from its nature, or by reason of this difference, requiring two motions to produce the proper effect. The pattern chain on "A" is so arranged as to produce its changes by the revolution only of the prism, or cylinder, upon which it is mounted; while that upon "B" cannot so act, but must first rotate and then be carried upwards in order to select the jacks for the figures. Another difference in detail is, that the jacks in "B" are not directly connected to the lams or levers of the harness, but act upon the lams through a tooth-sector in connection with discs or plates having a vibratory rotary motion. In these plates are slots, or grooves, so formed in their whole extent as to constitute cams for working the lams or levers, and from thence the harness leaves, through nearly their whole extent, but terminating in forms concentric, or nearly concentric, to the axis about which they rotate, so as to detain the harness in position at either extreme of its travel as may be required; both of which they are enabled to do by acting upon a roller or pivot upon an arm or lever attached to the lams or levers of the harness. As an adjunct to these sectors there are brakes, or friction pieces, held down upon the sectors by means of springs, to assist in the operation of making the changes and of detaining the harness in position when elevated or depressed, as the case may be. In this model "B," weights are made use of to assist in the selection of the jacks, while in the model "A" the tension of the con-
51 necting parts, serving as a spring for inducing the jacks into position, is made use of. These minor differences do not, in my judgment, change the character of the combination.

Int. 9. In your opinion, then, is the combination of mechanism for the purpose of forming and shifting the shed, shown in model "Complainant B," substantially similar to, or substantially different from, the combination of mechanism for that purpose shown in Model "A?"

Ans. Substantially the same.

And in answer to cross-interrogatories propounded to him by George Gifford, esq., deponent saith:

Cross-int. 1. Have you examined the reissue patent granted to George Crompton, assignee of Moses Marshall, dated April 24, 1860, and do you or not know what it contains?

Ans. I have not examined that patent sufficiently to know any considerable proportion of what it contains.

Cross-int. 2. Have you examined it?

Ans. I can hardly say that I have. What I have was merely casual.

Cross-int. 3. Are you acquainted with what is known as the Crompton loom?

Ans. Pretty well. I had occasion at one time to understand that loom thoroughly. It was some years ago. I remember that it was not an open shed loom. I remember that it did use lifters and depressers for opening the shed from a central line, and that it used a pattern chain, similar to that of Model "A," for determining the figure.

Cross-int. 4. Did or did not that Crompton loom have two sets of heddle levers or lams like Model "A?"

Ans. I am not able to say.

Cross-int. 5. Did or did it not have jacks which were operated up and down vertically, or nearly so, by reciprocating elevators and depressers?

Ans. It did, as well as I recollect, to the extent of half the opening of the shed to the elevators, and half the opening of the shed to the depressers.

52 Cross-int. 6. Was the mechanism in that Crompton loom substantially the same, or substantially different from the mechanism represented in Model "A," for moving the elevators and depressers?

Ans. To the extent that I have mentioned, that is, to half the opening of the shed, it was substantially the same, I believe; but whether precisely the same in detail I do not now recollect.

Cross-int. 7. Question repeated.

Ans. I don't think I can answer that question any better.

Cross-int. 8. Can you describe the mechanism in the Crompton loom used for raising and lowering the elevators and depressers?

Ans. I cannot precisely.

Cross-int. 9. Can you explain wherein it differs from the mechanism in Model "A" for raising and lowering the elevators and depressers?

Ans. I cannot, except in the difference I have mentioned. I remember that from the character of the loom they required to move through less space than in this loom.

Cross-int. 10. Can you state how the pattern chain and jacks were connected in that Crompton loom, if connected at all?

Ans. As well as I remember, the pattern chain acted upon the jacks substantially as in Model "A;" that is, for the purpose of determining which jack should be taken by the lifters and depressers.

Cross-int. 11. Do you remember by what mechanism, if any, in that Crompton loom, the jacks were connected to the heddles?

Ans. I do not distinctly, but I think it was by lams, or levers, and ties.

Cross-int. 12. Can you describe more particularly the mechanism referred to in the last question?

Ans. No; I could not.

Cross-int. 13. Have you ever seen a loom in practical operation—and, if yea, when and where—constructed like Model "A?"

Ans. I have never seen one.

Cross int. 14. Have you ever seen a loom in practical operation—and, if yea, when and where—constructed like Model "B?"

Ans. I have never seen one.

53 Cross-int. 15. Have you ever seen one of the Crompton looms in practical operation?

Ans. I have.

Cross-int. 16. At the close of your answer to eighth interrogatory-in-chief, you mentioned a combination. What combination do you mean? Please enumerate its parts.

Ans. I mean the combination referred too in the first part of the same answer, to wit, jacks, lifters, and depressers, a pattern chain and a device for detaining the jacks at the end of their extreme movement.

Cross-int. 17. Do you consider that the spring latches in Model "A" are mechanically combined with the elevators and depressers represented in that model?

Ans. Yes.

Cross-int. 18. By what means?

Ans. By means of the action of the parts all together, which go to make up the forming of the shed and holding it open.

Cross-int. 19. Enumerate those parts that you say altogether mechanically combine the spring catches with the elevators and depressers?

Ans. The jacks and the pattern chain.

Cross-int. 20. Do you consider the pattern chain and the spring catches, as represented in Model "A," in mechanical combination?

Ans. I believe they are, for the purposes of this organization.

Cross-int. 21. By what parts, according to your judgment, is the pattern chain mechanically combined with the spring catches, as represented in Model "A?"

Ans. The jacks, lifters, and depressers.

Cross-int. 22. Do you find spring catches in Model "B," according to your judgment?

Ans. I do not.

Adjourned to 20th, at 9½ a. m.

Resumed:

Cross-int. 23. In your answer to eighth interrogatory-in-chief, you have specified what you have called "minor differences," and which you think do not change the character of what you there set forth as
54 the combination. Do you think the character of the combination would be changed if the brakes were left out of machine represented by Model "B?"

Ans. I think it would not. I think as that model is now constructed and organized, that it might work without the brakes. I think they serve mainly to make the operation of the other parts less liable to accident by any displacement consequent upon friction or jar of the parts in action.

Cross-int. 24. Do you find any friction brakes in Model "A" performing such office?

Ans. I do not.

Cross-int. 25. Is not the office of the spring catches in Model "A" to hold up the jacks and to hold down the jacks until the notch or shoulder on the jack is slipped or pushed off of the spring catch?

Ans. I think it is.

Cross-int. 26. Is not the operation of one of those spring catches which holds the jack up to yield and spring back by the pressure of the inclined surface of the projection which forms the shoulder of the jack, as the jack ascends, until the shoulder has passed above the catch, when the catch is forced out by the spring to connect or lock with a shoulder on the jack?

Ans. It is.

Cross-int. 27. Suppose those spring catches were all removed from Model "A" and nothing substituted in their place, or to perform their office, would it make a substantial change in the character of what you have termed the combination?

Ans. I think it would.

Cross-int. 28. Can you think of any mechanism which you could put in Model "A," after so removing the spring catches, which would hold the jacks at the extreme limit of their motions up and down, for the purpose for which the spring catches hold the jacks when the spring catches are employed in the model, and have the character of the combination still changed, or substantially unlike what it was when the spring catches were employed?

Ans. I don't know whether I can or not. I don't think of any now.

Cross-int. 29. Please do the best you can in trying to think of
55 any such mechanism, and answer the above question. And by this I do not mean to insinuate that you did not give proper attention to the last question before answering it, but, as an eminent expert, I wish you, if you please, to make special effort to think of such a mechanism.

(Objected to.)

Ans. I don't think of any.

Cross-int. 30. How many substantial elements are there in the combination which you referred to in your answer to the eighth interrogatory-in-chief?

Ans. Four.

Cross-int. 31. In your judgment, would the removal of one of those parts, and replacing it by another substantially different, make a substantial change in the character of that combination?

(Objected to.)

Ans. I think it would; I suppose the question to mean by "one of those parts" one of the elements of the combination, and I suppose the question to mean that another element substantially different be put in place of the element removed.

Cross-int. 32. In your judgment, would a substantial alteration in one of those four elements of that combination make a substantial change in the character of the combination?

Ans. No. I think a substantial addition might be made to one of those elements without changing the general character of the organization.

Cross-int. 33. How would it be, in your judgment, if the substantial change in one of the four elements consisted of a substantial change without a substantial addition?

Ans. I don't like to answer that hypothetical question; if you will show me such an organization, I shall have an opinion about it.

Cross-int. 34. How are the elevators and depressers operated in Model "A?"

Ans. They are made to revolve about an axis.

Cross int. 35. What kind of jacks are adapted to that mode of operation of the elevators and depressers?

Ans. These jacks are forked so as to present the parts to be acted upon by the lifter and depresser upon either side of the axis about
56 which the lifter and depresser revolve, and seem to be well adapted for the purpose.

Cross-int. 36. What mechanism combines the jacks with the pattern chain in Model "A?"

Ans. The lifter and depresser, and the catches.

Cross-int. 37. What mechanism, as you understand it, combines the jacks with the pattern chain in Model B?

Ans. The lifter and depresser, and the concentric surfaces in the vibratory discs.

Cross-int. 38. Do you think you have stated all the mechanism which co nbines the jacks with the pattern chain in Model B?

Ans. Perhaps not; but these are the essential parts.

Cross-int. 39. What do you understand holds the jacks up and down, at the extreme limit of their motion, in Model "B?"

Ans. The jacks per se in Model "B" seem to be held up partly by the brakes upon the sectors, and partly by the bite of the lam levers upon

the concentric surfaces in the disc plates; when down, they will remain there by their own gravity, if not otherwise acted upon.

Cross-int. 40. In giving your testimony in reference to the combination of the four elements being substantially the same in Model "B" as in Model "A," did you assume that the mechanism for holding the jacks up and down at the extreme limit of their motions, was substantially the same in Model "B" as in Model "A?"

Ans. No; not of the jacks alone, but that the shed was held open by substantially the same means in the combination, as a whole.

Cross-int. 41. In both models the shed is held open by holding the jacks up and down at the limit of their motion, is it not?

Ans. Yes; that is to say, the shed is held open and the changes made using the jacks in the way the question supposes, with this difference—in the model "A" the shed is held open through the jacks as well as in connection with them; in the model "B" the shed is held open with the jacks, but not through them.

Cross-int. 42. Do you consider the mechanism for holding the jacks up and down substantially the same in the two models?

Ans. For all the purposes of this combination, yes. The precise differences, as I understand them, I have endeavored to point out in answer to former questions.

57 Cross-int. 43. Question repeated, and witness is requested to say whether he considers the mechanism which holds up and holds down the jacks in Model "B" substantially the same as the mechanism which holds up and holds down the jacks in Model "A."

Ans. I think it substantially the same for the purposes of this organization.

Cross-int. 44. Do you think it substantially different for any purpose?

Ans. I think it may be for some purposes.

Cross-int. 45. Do you know whether it is or not substantially different for any purpose?

Ans. I think it is for some purposes.

Cross-int. 46. By what are the jacks moved forward and back so as to connect and disconnect with the spring catches in Model "A?"

Ans. They are moved in one direction by the pattern chain, and in the other by the spring of the tension of their connections.

Cross-int. 47. By what means is the spring of the tension permitted to bring the jacks outward in Model "A," so as to lock in the spring catches?

Ans. By the negative action of the pattern chain.

Cross-int. 48. Do you think the mechanism for moving the jacks outward in Model "B" is substantially the same as the mechanism which moves them outward in Model "A?"

Ans. I do.

Cross-int. 49. Why?

Ans. Because the pattern chain does it in both of them, that is, determines and controls that operation in both of them.

Cross-int. 50. What operation?

Ans. The operation of bringing the jack outward so that it can be taken by the lifter or depresser, which is necessary to assist in the operation of placing the jack in position.

Cross-int. 51. Then you consider the two pattern chains substantially the same pattern chains, do you?

Ans. I do for the purposes of this organization. They have both been used in organizing fancy looms which did not make an open shed, and, as well as I remember, the pattern chain in "B" was in use for that purpose prior to the pattern chain in "A"?

58 Cross-int. 25. Do you consider the two pattern chains substantially different from each other for any purpose?

Ans. I do. For the purpose of a Jacquard loom, I think they would be substantially different.

Cross-int. 53. Do you mean to be understood as swearing positively that a pattern chain like that in Model "B" was used prior to that in Model "A?"

Ans. Yes. I mean to be understood as swearing that, according to the best of my recollection, a pattern chain, substantially like this in Model B, has been in use in a fancy loom. I notice in this pattern chain little buttons, by means of which the cards of the same chain can be made to serve for different figures. I do not recollect of having seen that feature before this examination.

Cross-int. 54. Do you mean the last answer as an affirmative answer to the last question?

Ans. I do, in view of my previous answers on this part of the subject.

Cross-int. 55. Please answer cross-question 53 without doing it in view, as you say you have done, of your previous answers.

Ans. I do not mean to be understood as swearing positively that a pattern chain precisely like that in Model "B" was used prior to that in Model "A?"

Cross-int. 56. Did you ever see substantially such a pattern chain as the one in Model "B" before this examination; if yea, when and where?

Ans. I never did, in any organized loom; and here I wish to qualify this answer by saying that for the purpose of making different figures on the same cards, I consider this pattern chain substantially different from such a pattern chain without the little buttons upon it.

Cross-int. 57. Did you ever out of an organized loom?

Ans. I don't remember that I ever did.

Cross-int. 58. By what mechanism, and by what mode of operation thereof, are the jacks moved inward, so as to lock upon the spring catches in Model "A?"

Ans. Immediately by the pattern chain in its revolution.

Cross-int. 59. By what part or parts of the pattern chain?

Ans. By the projecting parts.

59 Cross-int. 60. Do those projecting parts hold the jacks at their furthest inward position to which those projecting parts move them?

Ans. They do.

Cross-int. 61. What takes place, as to any motion of the jacks, when those projecting parts of the chain cease to hold them inward?

Ans. The jacks escape from the spring catches on one side, and are taken by the lifter, which lifts the same jack upwards until it is caught by the catch on the other side, carrying, at the same time, a leaf of heddles from the upper to the lower side of the shed.

Cross-int. 62. If you remove from Model "A" all those projections which push the jacks inward and hold them there, would you still have a pattern chain in that model, according to your judgment?

Ans. I should think not. I think the whole thing would be inoperative.

Cross-int. 63. Do you consider the mechanism in Model "B," for moving the jacks outward and inward, substantially the same as the mechanism for moving them outward and inward in Model "A?"

Ans. I do.

Cross-int. 64. The jacks are moved outward and inward in Model "A," to connect and disconnect them with the spring catches, are they not?

Ans. I think not. The main purpose is to determine the figure, by bringing the jacks to the action of the lifter and depresser. Incidentally, and as a part of this new contrivance, that same movement is made to serve in the use of the detaining mechanism for holding the shed open.

Cross-int. 65. In the old Crompton loom, the jacks were moved outward and inward for the purpose of bringing them to the action of the lifters and depressers, were they not?

Ans. I think so.

Cross-int. 66. You have stated that the projecting parts of the pattern chain move and hold the jacks inward in Model "A." For what purpose do they hold them there, and how long is it necessary for them to hold them there in the operation of the loom?

Ans. Until the exigency of the figure requires that particular
60 shade, so held, to be released from its position upon one side of the shed, and carried over to its position upon the other side of the shed.

Cross-int. 67. Are those projections, according to your judgment, sufficient for that purpose?

Ans. They are sufficient to hold the jacks in position, for that purpose, upon the catches.

Cross-int. 68. You have enumerated four parts, viz., jacks, lifters, and depressers, pattern chain, and a device for detaining the jacks at the end of their extreme movement, as the substantial elements constituting the combination to which you have referred. Do you think that those parts, combined with each other as represented in Model "A," would alone make a fancy loom that would practically operate? If not, what other parts do you consider it essential to add?

Ans. I do not. I don't see any lathe in the model; no yarn beam, no cloth beam, no shuttle, or shuttle motion, or let-off or take-up motion.

Cross-int. 69. With these parts added, would there then be sufficient to make a fancy loom which would practically operate in weaving fabrics?

Ans. There may be other parts, that I don't think of, necessary to it.

Cross-int. 70. Are you aware that the loom Model "A" would not practically operate without the sliding horizontal frame, in which two rollers are mounted, and to which the wedge-shaped ends of the lams or levers are adapted, which device is represented at the top of Model "A?"

Ans. I am; that is to say, I am aware that, in practical operation, this adjunct is very useful. But in the use of the word "practical," I wish to distinguish it from the word "practicable." I think the loom practicable without this adjunct, but perhaps I am mistaken. I do not feel very confident upon the subject.

Cross-int. 71. What is the office or function of the device which you have called "this adjunct," represented in Model "A?"

Ans. I have understood that one of its purposes was to hold the shed open while the pattern chain might be adjusted by hand after
61 any displacement. It appears, also, so far as I can see by the model, as an adjunct to the operation of change of figure or change of shed in the loom; but not having read the specification and description of the patent thoroughly, I have not the benefit of the inventor's explanation of its uses and purposes.

Cross-int. 72. How do you mean that it acts as an adjunct in the operation of the change of figure, or change of shed? Explain your meaning.

Ans. I mean that it makes the other parts more certain to act without accidental displacement.

Cross-int. 73. What other parts does it make more certain to act, and in what parts do you mean there might be accidental displacements?

Ans. More particularly the jacks and catches, and consequently the displacement of the harness.

Cross-int. 74. What do you mean by accidental displacements? Explain how, and from what cause, and in what parts it would or might occur.

Ans. In this model the lifters and depressers, having a revolving motion around an axis, disengage themselves from the shoulders upon the jacks by a movement in an arc of a circle, and, therefore, are more uncertain in their action as to the height to which they shall carry the jacks than they would be if they moved in a vertical direction only. They are also more likely to wear both themselves and the toes upon the jacks into a rounded form; so that thereby the precise action of the lifters and depressers upon the jacks becomes more indefinite. Now, these rollers, acting upon the lance-head shape, or spear-head shape, upon the ends of the lams of the upper series, serve to define more precisely the particular line of elevation or depression to which the jacks shall be brought, and they also serve to prevent accidents which might occur by the slippling off of the lifters and depressers from the shoulders upon the jacks after they have become worn, and also the slipping off from the catches by reason of their being worn.

Cross-int. 75. Have you now explained all that that device does, or is intended for, in the operation of the loom, so far as you know?

Ans. Yes.

Cross-int. 76. In your judgment, does the pattern chain in
62 Model "B" have the same mode of operation in the part which it takes in selecting jacks as does the pattern chain in Model "A" in the part it takes in selecting jacks?

Ans. I don't see but what it does. It certainly determines the figure, although it has two motions in order to do it, from the peculiar arrangement of the parts through which it acts, and from its own peculiar construction, while the other has but one.

Cross-int. 77. May not each of two pattern chains determine the figures, and nevertheless have different modes of operation?

Ans. I suppose they may.

Cross-int. 78. Do you find, according to your judgment, in Model "B," any mechanism between the pattern chain and the lams of the heddles, which has substantially a different mode of operation from any mechanism which you find between the pattern chain and the lams of the heddles in Model "A?"

Ans. No; I do not. I do not find any new modification of the whole combination referred to in my answer to the eighth direct interrogatory, going to change, or in any substantial degree modify, the combination existing in "A;" but I do find parts in "B" not precisely the same as in "A," which differences I have attempted to describe.

Cross-int. 79. If there were no slots in which the rollers operate in the sectors in Model "B," would the mechanism in such case between the pattern chain and the heddle lams have the same mode of operation as the mechanism does which is now between the pattern chain and the heddle lams in that model?

Ans. I suppose by slots you of course mean the two cams which form the sides of those slats; and if the organization and arrangement

of the parts be otherwise unchanged, the loom would not be operative at all, that I see.

Cross-int. 80. Do you find any such slots in the mechanism between the pattern chain and heddle lams in Model "A?"

Ans. I do not.

Cross-int. 81. If you were to remove the teeth from the periphery of the sectors, which are between the pattern chain and heddle lams of Model "B," leaving all other parts as they now are, would the mechanism in that case, between the pattern chain and the heddle lams, have the same mode of operation which it now has?

63 Ans. It would not. It wouldn't have any mode of operation, that I see, for the purposes of a fancy loom.

Cross-int. If you remove from Model "B" the front levers which act upon the jacks, leaving all other parts the same, in that case would the mechanism between the pattern chain and heddle cams, in your opinion, have substantially the same mode of operation as the mechanism now has which is between those points?

Ans. It wouldn't have any mode of operation that I can see.

Cross-int. 83. Do you find any such levers in Model "A?"

Ans. I do not; nor do I find any levers strictly as levers.

Cross-int. 84. Do you find any sector teeth in Model "A?"

Ans. I do not.

Cross-int. 85. If you remove from Model "B" the back levers which act upon the jacks, leaving all other parts unchanged, in that case would the mechanism between the pattern chain and the heddle lams have substantially the same mode of operation which the mechanism between those parts now has?

Ans. On examining the model it appears to me that it would; but such a loom might be a little uncertain in its mode of operation.

Cross-int. 86. If you remove from Model "B" the face cam, or the angular lever which connects that cam with the shaft, or standard which elevates or depresses the pattern chain, leaving all other parts the same, would the pattern chain then have substantially the same mode of operation in that model which it now has?

Ans. It wouldn't have any mode of operation that I see.

Cross-int. 87. Do you find any such cam or lever in Model "A?"

Ans. No.

Cross-int. 88. If you remove the buttons, or covers to the holes, in the pattern chain of Model "B," leaving all other parts unchanged, in your judgment, would the pattern chain then have substantially the same mode of operation upon the front levers which it now has in that model in determining the figure to be woven?

Ans. It wouldn't have any mode of operation, I believe, and it wouldn't be a pattern chain either, because there would be a hole to every needle, which there never is in pattern chains as practically used.

64 Cross-int. 89. If you remove from Model "B" the arms which connect the sectors with the heddle lams, leaving all other parts unchanged, would the mode of operation of the sectors upon the heddle lams then be substantially the same as it now is in that model?

Ans. There wouldn't be any mode of operation, I believe.

Cross-int. 90. If you remove the projections from the pattern chain in Model "A," would the pattern chain then have substantially the same mode of operation upon the jacks in that model as they now have, leaving all the other parts the same?

Ans. I believe it wouldn't have any mode of operation at all, but would cease to be a pattern chain.

Cross-int. 91. If you remove from Model "A" one of the series of the prongs of the jacks, say of the inner series, and leave all other parts the same, would the elevators and depressers have the same mode of operation upon the jacks in that case as they now have?

Ans. They would not. They wouldn't have any mode of operation, for any practical purpose, that I know of.

Cross-int. 92. In your judgment, are the spring catches in Model "A" employed in shifting the sheds?

Ans. To the extent that they must be detached from the jack, by removing the jack from them, before you can change the shed, and must engage themselves with the jack to hold it open after it is changed, they are employed. But in the actual change of the shade from side to side to form a new shed they are not employed.

Cross-int. 93. If you remove from Model "B" the brakes which act, upon the peripheries of the sectors, leaving all other parts unchanged would the mechanism remaining in that model have substantially the same mode of operation that the mechanism now in it has?

Ans. This model, as it stands, is not certain to operate properly without the brakes.

Cross-int. 94. Do you consider the brakes indispensable in maintaining its mode of operation?

Ans. I do not.

Cross-int. 95. If you remove from Model "A" the lower series of heddle lams, leaving all other parts unchanged, would the mode of operation of the remaining mechanism be substantially the same as is the mode of operation of the mechanism now in the model?

65

(Adjourned to 21st, at 9½ o'clock.)

Ans. I don't see that there would be any mode of operation in that case.

Cross-int. 96. Do you understand how the spring catches in Exhibit "A" can be applied to the old Crompton loom?

Ans. I do not. It is quite likely that it might be done, but at present I have no distinct idea how.

Cross-int. 97. In giving your answer to the third interrogatory-in-chief, did you assume that there is a mechanical equivalent in Model "B" for the spring catches in Model "A?"

Ans. I did.

Cross-int. 98. What did you assume to be such mechanical equivalent?

Ans. The concentric points or bearings at the ends of the cam movements in the disc plates.

Cross-int. 99. What do you understand to be a mechanical equivalent?

Ans. Just what the word implies—that it is equivalent in a mode of operation in a machine to some other thing not precisely like it.

Cross-int. 100. What do you mean by "equivalent in a mode operation?"

Ans. To take this machine as an example, I mean it is equivalent to the spring catches, because it holds the shed open.

Cross-int. 101. I notice in Model "A" a wooden piece on the frame at the outer ends of the upper series of heddle lams, what is it there for?

Ans. It appears to me to be put there to prevent the lurching of the part in the model which the model would be liable to do, for the reason that it has no web in it.

Cross-int. 102. Lurching of what parts? State from what cause they would lurch.

Ans. The parts are the harness, lams, jacks, and their connections uniting the whole. The action of the machine without a web might, from the inertia of the parts, carry them beyond the point to
66 which they were intended to be carried by the positive action of the loom, all of this being aided and assisted by the preponderance in weight of the jacks over and above the weight of the harness.

Cross-int. 103. What would be the consequence of such lurching of the jacks in their relation to the elevators and depressers and spring catches?

Ans. In this model such lurching would carry the jacks too low down for the proper action of the lifters and depressers in one direction; and if they remained down, which they would be likely to, from the preponderance of weight in the jacks, the spring catches which hold the jacks down would, of course, not act for that purpose. This would also be the case with a loom constructed like this model, when there was no web in it; but with a web in it, all this tendency to mischief would be overcome by the tension or spring of the piece or web, in my judgment.

Cross-int. 104. Then, if I understand you aright, no bearing corresponding with the wooden piece in the model for the heddle lams to rest on would be necessary in a loom in practical operation?

Ans. Not absolutely necessary, in my judgment. But I think that in rapid weaving, and in some cases where a very light portion of the web only is taken up for the upper shade, this provision might be very useful.

Cross-int. 105. Why do you think it would not be absolutely necessary?

Ans. Because that by making the jacks as light as they may be made, I think the loom might run without it.

Cross-int. 106. What would be the effect in that respect of having a warp or web in the heddles, in a practical operating loom? I mean with respect to dispensing in an operating loom with the rest represented by the wooden piece in the model.

Ans. I think the loom less likely to lurch with a web than without one.

Cross-int. 107. Why?

Ans. Because, as I have before stated, of the tension of the web acting upon the harness.

Cross-int. 108. Do you mean weight of the web as well as tension?

67 Ans. The weight of the web I did not contemplate in my answers. That would be something making in the same direction, but I think not much as compared with the tension. That would depend, however, very much upon how the piece was hung.

Cross-int. 109. In an operating loom, with a web in it, constructed, like Model A, without the wooden piece, and without the threads of the web being separated to form a shed, what ought to be the position of the heddle lams, and what ought to be the relative amount of pull upon each end of one of the heddle lams?

Ans. I think the lams should be substantially in a line with each other, and as nearly balanced in the relative pull of the two ends as may be; but I am not much of a practical weaver.

Cross-int. 110. Commencing with the parts in the position mentioned in the last question and answer, what effect, if any, would the opening of the warp to form a shed have in causing a strain or pull upon any part of the loom? Would the opening of the warp to form a shed exert or increase a strain or pull upon any part of the loom?

Ans. Undoubtedly, it would.

Cross-int. 111. On what part or parts? Explain.

Ans. On nearly all the parts connected with the harness, I should think, and on the cloth beam and yarn beam besides.

Cross-int. 112. Would not the opening of the warp to form a shed have a tendency, by the strain of the threads, to draw the heddle leaves together or nearer each other?

Ans. Not that I see. It would have a tendency to draw them into a line with each other.

Cross-int. 113. In Model "A," if heddle-leaf "No. 1" be moved upwards with threads in its heddles, and if heddle leaf "No. 2" be moved down with threads in its heddles, to form a shed, would not the strain of the threads have a tendency to resist such separation or motion of the heddle leaves?

Ans. It would; but as this model stands, with only two threads to each leaf of harness, the tendency is very slight.

Cross-int. 114. Would not the opening of the sheds in an operating loom, with a warp in it, have a similar tendency?

Ans. It would.

Cross-int. 115. What would be the effect upon the jacks, of
68 such tendency of the threads of warp in resisting the separation of the heddle leaves, in an operating loom?

Ans. The effect would be a tendency to bring the jacks in line with each other, and a tendency to carry the jacks outward from their harness.

Cross-int. 116. In the use of a loom like Model "A," is the pattern chain turned so as to change the figure when the shed is formed, or at what other time?

Ans. It is, I believe.

Cross-int. 117. When did you first see an old Cromptom loom?

Ans. I can't remember. My attention was first called particularly to that organization in a case of Crompton, or Crompton et al., against Cook, in the circuit court for this district, Judge Curtis on the bench.

Direct resumed:

Int. 10. In answer to the thirty-seventh cross-interrogatory you say that the lifter and depresser, and the concentric surfaces in the vibratory discs, are the mechanism which combines the jacks with the pattern chain in Model "B." Will you explain how they so combine them?

Ans. For the purposes of carrying out this contrivance of working an open-shed fancy loom, it becomes necessary, in addition to what has been done before, which was working a fancy loom without an open shed, to hold all the shades of the web in position, when once in position, except such as the exigencies of the figure might require to be detached at each throw of the shuttle, that they might be carried to the other side of the shed, and there again attached, so that at every change of a shade, from side to side, every one of the corresponding mechanical detents, or fastenings, for holding the shed open, had to be released before the shade could be carried to the other side and then the shade carried to the other side; and, after being carried to the other side, there again held by another detent, which had, somehow, to be brought into position for that purpose. Now, it is part of the office of the pattern chain to indicate the proper fastenings to be detached, in order that the proper shades shall be taken and carried by the lifter
and depresser, acting through the jack and the proper leaf of
69 harness, thus changing the shade to the proper position, where it

is again fastened through the action of the jack, but by the lifter and depresser. Now, in this model "B," when the pattern chain indicates the shade to be changed, it, at the same time, indicates the fastening which shall be disengaged. The fastening is disengaged by the action of the lifter or depresser, acting through the jack and tooth sector moving off the concentric surface from the lever upon the lams, and, immediately after, commencing to change the shade from side to side by the continued action of the lifter or depresser, acting upon the jacks through the tooth sector, and working the cam that changes the shade from side to side, and immediately thereafter bringing on the other concentric surface for the purpose of holding the shade in position, which other concentric surface had been also indicated by the pattern chain acting upon the jack, and which is accomplished by the lifter or depresser, still acting, through the jack, upon the tooth sector for that purpose.

Int. 11. Does the pattern chain in Model "B" have a suface composed of protuberances and depressions substantially?

(Objected to.)

Ans. It does; but the chain would work substantially the same, if, instead of the actual protuberances of the small buttons, there was only a plain plate without holes where the buttons are now turned over the holes, and there would then be protuberances as compared with the holes cut through the plate.

Int. 12. You say, in answer to sixty-sixth cross-interrogatory, that the protuberances of the pattern chain hold the jacks inward in Model "A" till the figure calls for that particular shade to go to the other side of the shed. Is this the result of having the pattern so set up that the protuberance which moves a given jack in is repeated consecutively in the line of chain, so long as the said jack is required to stay in?

(Objected to as leading.)

Ans. It is.

Int. 13. In the loom Model "B," is the protuberance, which acts upon a lever to move a jack to lift a leaf of heddles, repeated consecutively in the line of chain, so long as said leaf is required to stay up?

Ans. It is.

70 Int. 14. I understand you to say that the chain in Model "A" unlatches, or permits to be unlatched, the jacks which, with their corresponding heddles, the pattern requires to be moved or shifted. In Model B, does the chain select the jacks which are to be unlocked according to the requirement of the pattern, and dispose them so that the first movement of the elevator or depresser acting upon said jacks shall unlock them?

(Objected to as leading and for substance.)

Ans. Yes.

Int. 15. In each model, does the action of a protuberance of the chain produce the elevation of a corresponding leaf of heddles?

(Objected to as leading.)

Ans. Yes.

Int. 16. You say that you regard the concentric points or bearings at the ends of the slots in the sectors in Model "B" as the equivalents of the latches in Model "A;" and that you so regard them because they hold the shed open. In your opinion, are the latches in Model "A" and the concentric bearings in Model "B" substantially similar or substantially different mechanical detents, or detaining means, so far as regards their combination and co-operation with the rest of the [rest of the] mechanism, for the purpose of controlling the movement of the jacks?

(Objected to as leading.)

Ans. I regard them as the same. The latches themselves do nothing but hold the web open, that I can see. The concentric surfaces do nothing but hold the web open, that I can see. For engaging the latches in Model "A," the power seems to be furnished by the lifter or depresser, as the case may be, acting through the jack, crowding back the spring, which, by the power thus conveyed to it, returns the latch upon the shoulder of the jack. In Model "B," the concentric surfaces for holding the web open are brought into position by the power of the lifter or depresser, as the case may be, acting through the jack to bring the concentric surface into action directly without a spring, instead of indirectly with a spring. For the purpose of releasing the catches in Model "A," the action of the pattern chain seems to serve in one direction directly, and in the other direction indirectly. In Model "B," the action of the pattern chain indicates the proper disengagements, but the labor is performed by the lifter or depresser working through the jacks and sectors.

71 Cross resumed:

Int. 118. Do you not know that the pattern chain in Model "B" would have the same operation, if the holes desired to be stopped up were stopped up by something coming even with the surface of the cards in which the holes are made, as it does with the present buttons?

Ans. Yes, I do; and I've said so once or twice.

HERVEY WATERS.

Time for taking testimony in the above-entitled case is extended by agreement of parties to the 1st day of September next.

BOSTON, *July* 21, 1866.

72

73 TESTIMONY FOR THE DEFENCE.

Deposition of Edward S. Renwick.—Examination by Joshua D. Ball, esq.

Int. 1. What is your name, age, residence, and occupation?

Ans. Edward S. Renwick; 43 years of age and upwards; reside in the city of New York; and am occupied principally in soliciting patents, and in acting as expert in the trial of patent causes.

Int. 2. State whether or not you have had any experience in comparing inventions and mechanism with reference to the questions of novelty and similarity and differences; and, if yea, to what extent and how long; and whether or not you have testified as expert upon mechanical questions in the courts of the United States; and, if yea, whether frequently or how otherwise.

Ans. I have had much experience in such matters; for the past seventeen years I have been engaged in my present occupation, and during that period I have frequently had occasion to investigate the similarities and differences of machines of various descriptions, for performing a great variety of operations. I have also had to examine numerous descriptions of machines for the purpose of ascertaining whether machines described in patents or submitted to me for examination were novel. I have also been frequently called upon to testify as expert upon mechanical questions in the United States courts.

Int. 3. State whether or not you have had any, and, if any, what opportunities of becoming acquainted with looms and their mechanism.

Ans. I have. I have had to examine in the course of my business a great number of American patents for improvements in looms. I have had to prepare specifications of patents for improvements in looms. I have also had to examine a very large number of descriptions of
74 looms and their mechanism, as found in the printed records of English and French patents. I have had to examine the practical operation of a number of looms for weaving different varieties of fabrics, and I have been called upon to testify as expert in several patent cases, in which the construction and operation of looms was the subject-matter of the controversy.

Int. 4. Please state whether or not you have examined a certified copy of the letters patent of the United States, being reissue No. 947, granted to George Crompton, assignee of Moses Marshall, for an alleged improvement in looms for weaving figured fabrics, the original patent being dated Dec. 11th, 1849, and said reissue being dated April 24th, 1860; and whether you have examined the specifications and drawings annexed to said reissue, and whether or not you understand the mechanism therein set forth, and the construction and the operation thereof.

Ans. I have examined a certified copy of the reissued letters patent referred to in the question. I have examined the specification and drawings annexed to said certified copy, and I believe that I understand the construction and operation of the mechanism therein set forth.

Int. 5. Have you or not seen a loom of full size for practical use, with mechanism for forming and shifting the shed constructed as described and represented in said reissue, and did you or not see it operated?

Ans. I have seen a loom of full size, such as is referred to in the question, and I saw it operated.

Int. 6 Have you or not seen looms of the defendant's constructed like the model marked "Complainant B," and have you seen them operated?

Ans. I have seen a number of looms constructed substantially like the model marked "Complainant B," as far as respects the mechanism represented in that model, the looms having also the shuttle mechanism and other members which are required for practical weaving, and I have seen them operated.

Int. 7. Describe generally the combination of mechanism and its operation by which the shed is formed and shifted in the loom, described and represented in said reissue.

Ans. The combination of mechanism consists, first, of leaves of
75 heddles for holding the warp threads, and imparting movement directly to them; second, of connecting mechanism which connects the said leaves with the upper and lower ends of the jacks; third, of the jacks; fourth, of the elevator and depresser, or, more properly, of two bars, each of which acts alternately as an elevator and depresser; fifth, of the pattern mechanism; and, sixth, of holding mechanism, consisting of two parts, which are the spring catches and their appurtenances, and the evener and its appurtenances.

The operation of this combination is, first, that the heddles hold the warp threads so as to impart movement to them. Second, the connecting mechanism connects the jacks at both ends with the leaves of heddles, and operates to hold the jacks in such positions that the pattern mechanism can operate upon them. This mechanism also holds the jacks in such manner that the spring catches of the holding mechanism can act upon them, and hold them in the positions in which they are placed when raised. This connecting mechanism also holds the jacks

in proper position to be acted upon by the elevator, and holds them in engagement with the elevator during the raising of the jacks for the purpose of moving the heddles. Third, that the jacks, when raised or depressed, shall move the heddles through the connecting mechanism, and also, by reason of their being provided with double shoulders, shall engage with the spring catches of the holding mechanism when raised or depressed; such engagement being permitted, and a corresponding disengagement being also permitted, by reason of the jacks being so combined with the connecting mechanism, that a sufficient amount of lateral movement is permitted the jacks for those purposes. Fourth, that the elevator and depresser shall rise and descend a sufficient distance to move the jacks from one extremity of their range of motion to the other, and that they shall also disengage from the jacks when the latter have been moved to the extremities of their range of motion. Fifth, that the pattern mechanism shall select such jacks as are to be moved for the purpose of moving the heddles. That it co-operates with the connecting mechanism in moving such jacks laterally, or permits their movement by the connecting mechanism, for the purpose of carrying them out of the range of the spring catches of the holding mechan-
76 ism, so that these catches then offer no obstruction to the movement of the jacks; and also, for the purpose of placing the jacks, or permitting them to be placed (by the operation of the connecting mechanism), in proper positions for the elevator and depresser to act upon them. Sixth, that the holding mechanism, which is duplex, shall operate in the following manner: One part of the holding mechanism (which part consists of the two series of spring catches acting in connection with shoulders on the jacks) operates in combination with the pattern mechanism and connecting mechanism in such manner that the jacks are held by it, during about five-eighths of the revolution of the crank-shaft of the loom, in their elevated and depressed positions; and then such jacks as are to have their positions changed are either moved out of the range of the one set of catches by the operation of the pattern mechanism (moving them laterally), or are permitted to be moved out of the range of the other set of catches by the operation of the connecting mechanism (moving them laterally in a direction opposite to the lateral movement last mentioned), when the pattern mechanism permits such movement; this holding by the catches being effected while the pattern chain is at rest. The other part of the holding mechanism (which consists of the evener operating in connection with the ends of the upper series of heddle levers) operates to hold the jacks in their raised and depressed positions for about three-eighths of the revolution of the crank-shaft, while the pattern chain is being turned, and while the shuttle is passing through the shed. The mode in which the evener is made to so hold the jacks is as follows: The two sets of catches are necessarily arranged in the loom a little within the extreme range of motion of the jacks, in order that the catches may pass in freely under and above the shoulders of the jacks for the purpose of engaging with them; for, if this arrangement were not made, the spring catches would not be certain to engage with the said shoulders. The two rolls of the evener are arranged at such a distance apart that, when they are introduced (by the operation of the loom mechanism) between the ends of the upper series of heddle levers, the rolls hold the said levers, and consequently the jacks (that are directly connected with them), in their extreme positions; hence the movement of the evener between the inclined parts of the ends of the levers towards and on to the
77 straight parts of the said levers removes the shoulders of the

jacks slightly from the catches, and causes the whole strain of holding the jacks to be borne by the said evener. When the evener is not so holding the levers, and consequently the jacks, the shoulders of such jacks as are not moving are held in contact with the spring catches by the tension of the warp threads acting upon the heddles; for these warp threads being elastic, and being deflected in an upper and lower direction from a straight line by the elevation and depression of the heddles, tend to regain that straight line as a bowstring does when deflected, and consequently exert a strain upon the jacks, tending to move those that are raised and depressed to their mean positions. Hence the jacks, when raised and depressed, are held by one member of the holding mechanism (the spring catches operating upon the shoulders of of the jacks), while the other member or part (the evener) is not acting, and are held by the other member or part of the holding mechanism (the evener) while the spring catches are not operating upon the shoulders of the jacks. The second part of the holding mechanism (the evener) also performs an important function in the combination, by assisting in shifting the shed. From the above-mentioned action of the warp threads through the heddles and connecting mechanism upon the jacks, those jacks which are to be moved (for the purpose of shifting the shed) tend to move from their extreme raised or depressed positions towards their mean position the moment the holding mechanism liberates them. When the pattern chain turns, the raised jacks which are to be depressed are moved laterally, so that their shoulders will not overlap the upper series of spring catches; while those depressed jacks which are to be raised are also moved laterally (by the operation of the connecting mechanism), so that their shoulders do not underlap the lower set of catches; hence the catches would, at these times, afford no obstacle to the movement of the jacks, and as the tension of the warp threads tends to move the jacks towards their central positions, they would (unless otherwise controlled) immediately, after being moved laterally as above stated, be moved to their central positions in advance of the operations of the elevator and depresser, and while the shuttle was passing through the shed. The result of such movement
78 would be the partial closing of the shed, the obstruction of the shuttle, and probably the misplacement of some of the threads of the warp in the pattern. Such defective operation of the jacks is prevented by the evener, which holds the heddle levers and jacks until the lateral movement of the jacks is finished, and then, by moving gradually outward, between the inclined ends of the heddle-levers, controls their movement and that of the jacks, thereby preventing the jacks and the heddles from being moved too rapidly by the strain of the warp threads, preventing the premature closing of the shed, and so controling the jacks in their movement that they move towards their mean positions but little in advance of the elevator and depresser, thereby preventing them from striking the shoulders of the jacks with a jarring blow.

The result, as respects weaving, that is accomplished by the operation of the combination of mechanism which I have described is, that those warp threads which are not to be shifted previous to the passage of the shuttle are retained in their depressed and elevated position until they are to be shifted; the heddles and the jacks with which they are connected being held in corresponding positions by the operation of the duplex holding mechanism.

Int. 8. Please describe a little more fully the mechanism which you call, in your next preceding answer, the connecting mechanism, and state the operation of the connecting rods which are attached to the outer ends of the lower series of heddle levers.

Ans. The connecting mechanism intervenes between the jacks and the leaves of heddles. It is composed of two parts. One of these parts connects the upper bars of the leaves of heddles with the upper ends of the jacks, and consists of the upper series of heddle levers, and the links and straps intervening between their inner ends and the leaves of heddles. The other part connects the lower bars of the leaves of heddles with the lower ends of the jacks, and consists of the lower series of heddle levers, the rods or straps which intervene between their inner ends and the leaves of heddles, and the rods which connect the outer ends of the lower series of hedlde levers with the lower ends of the jacks. This connecting mechanism, with the leaves of heddles and the jacks, forms a continuous circuit, the members of which, in practice, are under tension; the straps or rods being made sufficiently short
79 to produce a strain upon all the parts. The lower series of heddle levers are longer than the upper series; their inner ends are arranged directly beneath the inner ends of the upper series, consequently the outer ends of the lower series of levers project at the side of the loom further than the corresponding ends of the upper series. The pattern mechanism is so arranged relatively to the jacks, that it holds the jacks from moving outward from the side of the loom materially beyond a vertical position. Consequently the line of the connecting rod at the lower end of each jack extends obliquely outward from it, in passing to the outer end of the lower heddle lever. By reason of this obliquity, the strain or tension of the connecting mechanism tends to pull the lower ends of the jacks outward, and cause them to vibrate upon the pivots which connect them with the upper series of heddle levers. This outward tendency causes the jacks to bear against the cam projection of the pattern chain, and when no cam upon the bar of the chain is presented to the jack, the jack is caused to bear against the bar of the chain; in the latter case, if the chain be turned, and a cam be thereby presented against the jack, the latter is moved laterally by the action of the cam, antagonistically to the strain caused by the oblique position of the connecting rod; and on the other hand, if a cam be bearing against a jack, and the pattern chain be then moved so that the cam is removed, and no other cam follows it on the next succeeding bar of the chain, the oblique action of the connecting rod enables the strain of the connecting mechanism to move the jack laterally outward from the loom. The pattern mechanism thus moves the jack laterally in one direction, and permits its movement laterally in the opposite direction by the connecting mechanism.

Int. 9. Please state whether or not the combination of mechanism for the purpose of forming and shifting the shed, shown in complainant's Model B, is the same, or substantially the same, as the combination for that purpose described by you as existing in the loom, described and represented in said reissue; and please give your reasons for your opinion, first stating whether you have examined the said Model B, and understand the mechanism thereby represented, and its construction and operation.

Ans. I have examined complainant's Model "B," and believe that I understand the construction and operation of the mechanism there-
80 by represented. In my opinion the combination of mechanism shown in that model, for the purpose of forming and shifting the shed, is substantially different from the combination for that purpose described by me as existing in the loom described and represented in the said reissue. My reasons for this opinion are as follows: The combination of mechanism for the purpose of forming and shifting the shed

jacks slightly from the catches, and causes the whole strain of holding the jacks to be borne by the said evener. When the evener is not so holding the levers, and consequently the jacks, the shoulders of such jacks as are not moving are held in contact with the spring catches by the tension of the warp threads acting upon the heddles; for these warp threads being elastic, and being deflected in an upper and lower direction from a straight line by the elevation and depression of the heddles, tend to regain that straight line as a bowstring does when deflected, and consequently exert a strain upon the jacks, tending to move those that are raised and depressed to their mean positions. Hence the jacks, when raised and depressed, are held by one member of the holding mechanism (the spring catches operating upon the shoulders of of the jacks), while the other member or part (the evener) is not acting, and are held by the other member or part of the holding mechanism (the evener) while the spring catches are not operating upon the shoulders of the jacks. The second part of the holding mechanism (the evener) also performs an important function in the combination, by assisting in shifting the shed. From the above-mentioned action of the warp threads through the heddles and connecting mechanism upon the jacks, those jacks which are to be moved (for the purpose of shifting the shed) tend to move from their extreme raised or depressed positions towards their mean position the moment the holding mechanism liberates them. When the pattern chain turns, the raised jacks which are to be depressed are moved laterally, so that their shoulders will not overlap the upper series of spring catches; while those depressed jacks which are to be raised are also moved laterally (by the operation of the connecting mechanism), so that their shoulders do not underlap the lower set of catches; hence the catches would, at these times, afford no obstacle to the movement of the jacks, and as the tension of the warp threads tends to move the jacks towards their central positions, they would (unless otherwise controlled) immediately, after being moved laterally as above stated, be moved to their central positions in advance of the operations of the elevator and depresser, and while the shuttle was passing through the shed. The result of such movement
78 would be the partial closing of the shed, the obstruction of the shuttle, and probably the misplacement of some of the threads of the warp in the pattern. Such defective operation of the jacks is prevented by the evener, which holds the heddle levers and jacks until the lateral movement of the jacks is finished, and then, by moving gradually outward, between the inclined ends of the heddle-levers, controls their movement and that of the jacks, thereby preventing the jacks and the heddles from being moved too rapidly by the strain of the warp threads, preventing the premature closing of the shed, and so controling the jacks in their movement that they move towards their mean positions but little in advance of the elevator and depresser, thereby preventing them from striking the shoulders of the jacks with a jarring blow.

The result, as respects weaving, that is accomplished by the operation of the combination of mechanism which I have described is, that those warp threads which are not to be shifted previous to the passage of the shuttle are retained in their depressed and elevated position until they are to be shifted; the heddles and the jacks with which they are connected being held in corresponding positions by the operation of the duplex holding mechanism.

Int. 8. Please describe a little more fully the mechanism which you call, in your next preceding answer, the connecting mechanism, and state the operation of the connecting rods which are attached to the outer ends of the lower series of heddle levers.

Ans. The connecting mechanism intervenes between the jacks and the leaves of heddles. It is composed of two parts. One of these parts connects the upper bars of the leaves of heddles with the upper ends of the jacks, and consists of the upper series of heddle levers, and the links and straps intervening between their inner ends and the leaves of heddles. The other part connects the lower bars of the leaves of heddles with the lower ends of the jacks, and consists of the lower series of heddle levers, the rods or straps which intervene between their inner ends and the leaves of heddles, and the rods which connect the outer ends of the lower series of hedlde levers with the lower ends of the jacks. This connecting mechanism, with the leaves of heddles and the jacks, forms a continuous circuit, the members of which, in practice, are under tension; the straps or rods being made sufficiently short
79 to produce a strain upon all the parts. The lower series of heddle levers are longer than the upper series; their inner ends are arranged directly beneath the inner ends of the upper series, consequently the outer ends of the lower series of levers project at the side of the loom further than the corresponding ends of the upper series. The pattern mechanism is so arranged relatively to the jacks, that it holds the jacks from moving outward from the side of the loom materially beyond a vertical position. Consequently the line of the connecting rod at the lower end of each jack extends obliquely outward from it, in passing to the outer end of the lower heddle lever. By reason of this obliquity, the strain or tension of the connecting mechanism tends to pull the lower ends of the jacks outward, and cause them to vibrate upon the pivots which connect them with the upper series of heddle levers. This outward tendency causes the jacks to bear against the cam projection of the pattern chain, and when no cam upon the bar of the chain is presented to the jack, the jack is caused to bear against the bar of the chain; in the latter case, if the chain be turned, and a cam be thereby presented against the jack, the latter is moved laterally by the action of the cam, antagonistically to the strain caused by the oblique position of the connecting rod; and on the other hand, if a cam be bearing against a jack, and the pattern chain be then moved so that the cam is removed, and no other cam follows it on the next succeeding bar of the chain, the oblique action of the connecting rod enables the strain of the connecting mechanism to move the jack laterally outward from the loom. The pattern mechanism thus moves the jack laterally in one direction, and permits its movement laterally in the opposite direction by the connecting mechanism.

Int. 9. Please state whether or not the combination of mechanism for the purpose of forming and shifting the shed, shown in complainant's Model B, is the same, or substantially the same, as the combination for that purpose described by you as existing in the loom, described and represented in said reissue; and please give your reasons for your opinion, first stating whether you have examined the said Model B, and understand the mechanism thereby represented, and its construction and operation.

Ans. I have examined complainant's Model "B," and believe that I understand the construction and operation of the mechanism there-
80 by represented. In my opinion the combination of mechanism shown in that model, for the purpose of forming and shifting the shed, is substantially different from the combination for that purpose described by me as existing in the loom described and represented in the said reissue. My reasons for this opinion are as follows: The combination of mechanism for the purpose of forming and shifting the shed

contained in Model "B" has a connecting mechanism for the purpose of connecting the jacks with the leaves of heddles, which is a substantially different mechanism from the connecting mechanism of said reissue, and, in addition, is combined in a substantially different way with the other members of the loom from that in which the connecting mechanism of said reissue is combined with the other members of the combination of which it forms a part; thus, the connecting mechanism of said reissue is divided into two parts, one of which is connected with the upper ends of the jacks, and the other of which is connected with their lower ends; while the connecting mechanism of said Model "B" consists of one connected series of instrumentalities which connect with the lower ends of the jacks only. The connecting mechanism of said reissue consists of a series of levers and rods, or straps, which transmit motion directly from the jacks to the heddles, so that when the jacks are moved the heddles are moved correspondingly and equally; while the connecting mechanism of Model "B" contains among its members a series of curved cam slots, which modify the movement transmitted from the jacks to the heddles, so that the latter are not moved equally for equal movements of the jacks. The connecting mechanism of said reissue is so combined with the jacks that they are moved laterally by it, for the purpose of engaging with the upper set of spring catches of the holding mechanism, and for the purpose of being put in proper positions for the elevator to act upon them; also, that the jacks are held by said connecting mechanism in engagement with the elevator while they are being raised; while the combination of the connecting mechanism of Model "B" with the other members of that model is such, that the jacks are not and cannot be moved laterally by it, and that it is not one of the means of performing any one of the above-mentioned three purposes. The connecting mechanism of Model "B" is of such construction, and is so com-
81 bined with the friction brakes of that model, that when the cam sectors are so moved that the concentric portions of the cam slots are opposite to the friction wheels at the ends of the T-shaped heddle levers, the said levers and the heddles with which they are connected are held in their extreme positions (although such concentric portions of the cam slots present no obstruction to the movement of the jacks); while the combination of the connecting mechanism of said reissue with the other members of the combination is such that the above-mentioned mode of operation is not produced by it and cannot be produced by it; moreover, there are no friction brakes in the combination of said reissue, with which the connecting mechanism thereof could be combined and no equivalents for such friction brakes. In fact, the construction and combination of the connecting mechanism of Model "B" are so entirely different from the construction and operation of the connecting mechanism of said reissue, that if the latter were removed from the combination of which it forms a part, and an attempt was made to put in its place the connecting mechanism of Model "B," the new combination resulting from such change (if it could be accomplished) would be inoperative and useless for the purpose of forming and shifting a shed in a loom.

The combination of mechanism for the purpose of forming and shifting the shed contained in Model "B" has a set of jacks which are constructed substantially different from the jacks of said reissue, and are combined with the other members of the mechanism in a manner substantially different from that in which the jacks of said reissue are combined with the other members of the combination of said reissue. Thus the jacks of said model "B" have but one pair of shoulders upon which the elevator and depresser act; while the jacks of said reis-

sue have two pairs of shoulders, one to engage with the elevator and depresser, and the other pair to engage with the series of spring catches of the holding mechanism. The jacks of Model "B" are combined at one end only with the connecting mechanism, while the jacks of said reissue are combined at both ends with the connecting mechanism. The jacks of said reissue are combined with two sets of spring catches, in order that they may be held by said catches during a portion of the revolution of the crank-shaft of the loom; the jacks of Model "B" are not
82 combined with such catches, nor are there any spring catches in said Model "B" with which they could be combined, nor any equivalents for such catches. In fact, the jacks of Model "B" are so substantially different from the jacks of said reissue, that if the latter were removed from the combination of which they form a part, and the former were put in their places, the new combination of mechanism produced would be inoperative and valueless for the purpose of holding open the shed during a material portion of the operation of the loom when it is desirable it should be held open, and when it is held open by the operation of the combination of said reissue, even if the jacks could be moved by the elevator and depresser of said reissue.

The combination of mechanism for the purpose of forming and shifting the shed in Model B has a pattern mechanism which is combined with the other members of that combination in a manner which is substantially different from that in which the pattern mechanism of said reissue is combined with the other members of the combination of which it forms a part. Thus, the pattern mechanism of said reissue co-operates with the connecting mechanism thereof to produce the lateral movement of the jacks in opposite directions; no such co-operation with the connecting mechanism exists in the combination of Model "B." The pattern mechanism of said reissue is so combined with the other members of the combination, that it holds the jacks which are depressed in proper positions to engage with the lower series of catches; it also permits the connecting mechanism to hold the jacks in proper positions to engage with the upper series of catches. No such combination of the pattern mechanism of Model "B" exists. Moreover, the pattern mechanism of Model "B," if applied to the combination of said reissue, instead of the pattern mechanism thereof, would be incapable of holding the jacks in positions to engage with one of the series of catches at a period when the jacks are so held by the pattern mechanism of said reissue, because at that period the pattern chain of Model "B" would necessarily have to be moved away from the jacks, for the purpose of being turned. The pattern mechanism of said reissue moves the raised jacks out of the range of the upper series of spring catches, and also permits the depressed jacks to be moved out of the range of the lower series of catches
83 by the operation of the connecting mechanism, and these functions of the pattern mechanism are indispensable in the combination of which it forms a part. No such functions and no equivalent functions are performed by the pattern mechanism of Model "B," for that model has no catches to obstruct the movement of the jacks.

The combination of mechanism for the purpose of forming and shifting the shed in Model "B" has a holding mechanism for holding the jacks in their raised and depressed positions, which is substantially different from the mechanism for holding the jacks in the combination of said reissue, and is combined with the other members of the combination of which it forms a part, in a manner that is substantially different from that in which the holding mechanism of said reissue is combined with the other members of the combination thereof; thus, the

holding mechanism of the combination of said reissue has two sets of catches, which operate in connection with supplementary shoulders formed upon the jacks; the said mechanism has also the "evener," which operates upon the upper series of heddle levers, and the catches and their appurtenances hold the jacks during a portion of the operation of the loom, while the "evener" holds the jacks during the remaining portion of the operation of the loom; the mechanism of Model "B" has but one set of holding mechanism for holding the jacks, such holding mechanism consisting of the friction brakes operating upon the rims of the cam sectors. Both of the parts of the holding mechanism of said reissue operate in the manner of the bolt of a door lock, to engage with projections upon, in one case, the jacks, and, in the other case, with the projecting ends of the heddle levers, which are connected directly with the jacks. The holding mechanism for holding the jacks, of Model B, operates by frictional pressure like a railroad brake. The holding mechanism of said reissue is of necessity combined with the other members of the combination, of which it forms a part, in such manner that a disengagement and separation of the catches and evener from the parts upon which they act must be effected before the jacks can be moved, or, in other words, the jacks must be liberated from the action of the holding mechanism; consequently the holding mechanism of said reissue is of necessity combined with the other members of the
84 combination in the manner that I have mentioned when speaking specially of them. The holding mechanism of Model "B" is combined with the other members of the combination of which it forms a part in such manner that it is never disengaged or separated from the parts (the cam sectors) upon which it acts, and that the jacks are never liberated from its action. The holding mechanism of said reissue is so combined with the other members of the combination of which it forms a part, that it holds the jacks only when in their raised and depressed positions; while the holding mechanism of Model "B" holds the jacks in any positions in which they may be placed, and holds them equably during their entire range of movement.

The above stated differences in construction, operation, and combination are, in my opinion, substantial, and render the combination for forming and shifting the shed in Model B substantially different from the combination of said reissue.

Adjourned till Sept. 3, 1866, at 10 o'clock.

MONDAY, *Sept.* 3.

Int. 10. Suppose that the evener be thrown out of the combination, described by you as existing in the loom described and represented in said reissue, and that the combination so produced operates to move and hold the jacks in the manner set forth in said reissue, state whether or not you then find in the loom represented by Model "B" a combination which is the same, or substantially the same, as the said combination without the evener in the loom described and represented in said reissue, and please give also your reasons for your opinion.

Ans. Having made the supposition recited in the question, I am of opinion that the loom represented by Model "B" does not contain a combination which is the same or substantially the same as the said combination without the evener in the loom described and represented in said reissue. My reasons for this opinion are the same as those given in my answer to the previous question, leaving out what I have therein said in reference to the evener.

Int. 11. Suppose the combination in said reissue is the combination of

the jacks, that operate the series of leaves of heddles, with the lifter and depresser, and pattern chain (or any equivalent apparatus
85 for determining the pattern), and the mechanism for holding the jacks either in their elevated or depressed position when not required to be operated, all substantially as in said reissue set forth; will you then state whether or not you then find substantially the same, or substantially a different, combination in the loom represented by Model "B," assuming in the first place, in making your answer, that the spring latches or catches, with the outer shoulders of the prongs of the jacks, and also the evener, constitute the holding mechanism; and then assuming, in making your answer, that the spring latches or catches, with the outer shoulders of the prongs of the jacks, constitute without the evener the holding mechanism? Please give your reasons for your opinion.

Ans. Under each of the assumptions recited in the latter part of the question, I am of opinion that the loom represented by Model "B" contains a substantially different combination from that recited in the question. My reasons for this opinion are as follows: Under the first assumption stated in the latter part of the question, the combination of mechanism for the purpose of forming and shifting the shed contained in Model "B" has a set of jacks which are constructed substantially different from the jacks of the combination inquired of, and are combined with the other members of the mechanism in a manner substantially different from that in which the jacks of said combination inquired of are combined with its other members; thus, the jacks of said model "B" have but one pair of shoulders upon which the elevator and depresser act, while the jacks of said combination inquired of have two pairs of shoulders, one pair to engage with the elevator and depresser, and the other pair to engage with the series of spring catches of the holding mechanism. The jacks of said combination inquired of are combined with two sets of spring catches, in order that they may be held by said catches during a portion of the revolution of the crank-shaft of the loom; the jacks of Model "B" are not combined with such catches, nor are there any spring catches in said Model "B" with which they could be combined, nor any equivalents for such catches. In fact, the jacks of Model "B" are so substantially different from the jacks of said combination inquired of, that if the latter were removed therefrom, and the former were put in their places, the new combination of
86 mechanism produced would be inoperative and valueless for the purpose of holding open the shed during a material portion of the operation of the loom when it is desirable it should be held open, and when it is held open by the operation of said combination inquired of, even if the jacks could be moved by the elevator and depresser of said combination inquired of.

The combination of mechanism for the purpose of forming and shifting the shed in Model "B" has a pattern mechanism which is combined with the other members of that combination in a manner which is substantially different from that in which the pattern mechanism of said combination inquired of is combined with its other members. Thus, the pattern mechanism of said combination inquired of is so combined with the other members that it holds the jacks which are depressed in proper positions to engage with the lower series of catches; it also permits the jacks to be held in proper positions to engage with the upper series of catches. As Model "B" contains no catches, nor equivalents for them, no such combination of the pattern mechanism of that model with catches or equivalents for them exists; moreover, the pattern mechanism of Model "B," if applied to the combination inquired of instead of

the pattern mechanism thereof, would be incapable of holding the jacks in position to engage with one of the series of catches when the jacks are so held by the pattern mechanism of said combination inquired of, because at that period the pattern chain of Model "B" would necessarily have to be moved away from the jacks, for the purpose of being turned, and the jacks at that time are all moved into the same plane. The pattern mechanism of said combination inquired of moves the raised jacks out of the range of the upper series of spring catches, and also permits the depressed jacks to be moved out of the range of the lower series of catches, and these functions of the pattern mechanism are indispensable to the combination of which it forms a part. No such functions and no equivalent functions are performed by the pattern mechanism of Model "B," for that model has no catches to obstruct the movement of the jacks.

The combination of Model "B" has a holding mechanism for holding the jacks in their raised and depressed positions which is substantially different from the mechanism for holding the jacks in the combination inquired of, and is combined with the other members in a manner which is substantially different from that in which the holding mech-
87 anism of said combination inquired of is combined with its other members. Thus, the holding mechanism of the combination inquired of has two sets of catches, which operate in connection with supplementary shoulders formed upon the jacks, and has also the evener; and the catches and their appurtenances hold the jacks during a portion of the operation of the loom, while the evener holds the jacks during the remaining portion of the operation of the loom. The mechanism of Model "B" has but one set of holding mechanism for holding the jacks, such holding mechanism consisting of the friction brakes operating upon the rims of the cam sectors. Both of the parts of the holding mechanism of said combination inquired of operate in the manner of the bolt of a door lock, to engage with projections upon, in one case, the jacks, and, in the other case, with the projecting ends of the heddle levers, which are connected directly with the jacks. The holding mechanism for holding the jacks of Model "B" operates by frictional pressure like a railroad brake. The holding mechanism of said combination inquired of is of necessity combined with the other members in such manner that a disengagement and separation of the catches and evener from the parts upon which they act must be effected before the jacks can be moved, or, in other words, the jacks must be liberated from the action of the holding mechanism; consequently the holding mechanism of said combination inquired of is of necessity combined with the other members in the manner which I have mentioned when speaking specially of them. The holding mechanism for holding the jacks of Model "B" is combined with the other members of the combination in such manner that it is never disengaged or separated from the parts (the cam sectors) upon which it acts, and that the jacks are never liberated from its action. The holding mechanism of said combination inquired of is so combined with the other members that it holds the jacks only when in their raised and depressed positions; while the holding mechanism of Model "B" holds the jacks in any position in which they may be placed, and holds them equably during their entire range of movement.

Under the second assumption contained in the latter part of the question, viz., that the combination supposed consists of the jacks, the lifter and de-
88 presser, the pattern chain, and the catches operating upon the outer shoulders or the prongs of the jacks (without the evener), my reasons for my opinion are the same as I have above stated in this an-

swer in reference to the jacks and the pattern mechanism, viz., as far as the paragraph commencing with the words, "The combination of Model B has a holding mechanism." In addition to said reasons I have the following: The combination of Model B has a holding mechanism for holding the jacks in their raised and depressed positions which is substantially different from the mechanism for holding the jacks in the combination inquired of, and is combined with the other members in a manner which is substantially different from that in which the holding mechanism of said combination inquired of is combined with its other members; thus, the catches and their appurtenances hold the jacks during a portion of the operation of the loom, and operate in the manner of the bolt of a door lock to engage with projections upon the jacks; the holding mechanism for holding the jacks of Model B holds them in their raised and depressed positions during the entire operation of the loom (except, of course, those jacks that are being shifted), and operates by frictional pressure like a railroad brake. The spring catches of said combination inquired of are of necessity combined with the other members in such manner that a disengagement and separation of the catches from the parts upon which they act must be effected before the jacks can be moved, or, in other words, the jacks must be liberated from the action of the holding mechanism, consequently the catches of said combination inquired of are combined with other members in the manner in which I have mentioned when speaking specially of them. The holding mechanism of Model B is combined with the other members in such manner that it is never disengaged, or separated from the parts upon which it acts, and that the jacks are never liberated from its action.

Int. 12. Suppose the spring latches, or catches, with the shoulders on the jacks on which the latches or catches act, set forth in said reissue, do in point of fact hold the jacks in their elevated and depressed positions during the whole time that they are required to be held in their elevated and depressed positions; do you or not, then, find the same, or substantially the same, combination in said Model B that you would under those circumstances find in said reissue?

Ans. I do not find the same, or substantially the same, combination in Model B.

89 Int. 13. State whether or not the loom represented by Model B contains the combination, or substantially the combination, described in said reissued patent, and referred to in the first claim thereof, and state your reasons.

Ans. In my opinion it does not, for the reasons given by me in my answer to the 11th interrogatory under the second assumption.

Int. 14. State whether or not the loom represented by Model B contains the combination, or substantially the combination, described in said reissued patent, and referred to in the first claim thereof under either of the assumptions contained in the 11th interrogatory, and state your reasons.

Ans. In my opinion it does not, for the reasons given in my answer to the 11th interrogatory.

Int. 15. Do the concentric forms, or either of them, in the slots in the sector in the loom represented by Model B, hold or have any agency in holding the jacks in that loom either in their elevated or depressed positions? And give your reasons.

Ans. They do not, for the reason that the concentric portions of the slots are in the line of movement of a member (the cam sector) that is connected with the jacks, and therefore do not and cannot hold the jacks. The member in which the concentric parts of the slots are formed,

namely, the cam sector, rocks upon a shaft; and consequently every part of the sector in moving with the jack describes the arc of a circle, of which the axis of the shaft is the centre; the concentric parts of the slots are circular arcs, having the same centre as the sector, and are therefore in the line of movement of the sector which is connected with the jack.

Int. 16. Have the concentric parts of the sector cam slots in the loom represented by Model B the same or substantially the same relation, combination, or mode of operation, in conjunction with the jacks, lifters, and depressers, and pattern mechanism of said loom, for any purpose, as the combination of jacks, lifters, and depressers, pattern mechanism, and holding mechanism in the loom described in said reissue, assuming that the holding mechanism in said reissue is the spring latches or catches, with the outer shoulders of the prongs of the jacks, or any equivalent mechanism?

Ans. They do not, for the reason that the concentric portions
90 of the cam slots are substantially different instrumentalities from the holding mechanism assumed in the question; that they are combined in a substantially different manner with the other members of the loom; that they have a substantially different mode of operation from the assumed holding mechanism; and that they do not accomplish the result accomplished by the assumed holding mechanism, as stated by me in detail in my previous answers.

Int. 17. Please answer the preceding question, supposing that the evener, with the spring latches or catches with the outer shoulders of the prongs of the jacks, or any equivalent mechanism, constitute the holding mechanism in the loom described in said reissue, and give your reasons.

Ans. The concentric portions of the cam slots in the loom represented by Model B have not, for the reason that the said portions are substantially different instrumentalities from the holding mechanism assumed in the question; that they are combined in a substantially different manner with the other members of the loom; that they have a substantially different mode of operation from the holding mechanism assumed in the question; and that they do not accomplish the result accomplished by the assumed holding mechanism, as stated by me in detail in my previous answers.

Int. 18. State whether or not you have witnessed any experiments with the loom referred to by you in your answer to the 5th interrogatory. If yea, state when and where you witnessed the same, and who was or were then present, if any one, and what the experiments were, and with what results.

(Objected to.)

Ans. I have witnessed experiments made with the loom referred to in the question. They were made with the loom at the Arlington Mills, at Lawrence, Massachusetts, last week, and particularly on Wednesday, Aug. 29th. The persons who were present on that day particluarly were Robert Davis, Leonard Pearce, Samuel T. Thomas, Francis C. Treadwell, jr., Joshua D. Ball, and several operators employed in the mill, whose names I do not know. The experiments tried were for the purpose of ascertaining how the loom worked practically, the speed at which it could be run, and whether it could be worked practically with the evener removed, so that the spring catches operating upon
91 the outer shoulders of the prongs of the jacks constituted the holding mechanism for holding the jacks. The results of those experiments were, that the loom was very uncertain in its operation,

as the jacks, when being raised, were liable to detach themselves, and did detach themselves, from the elevator, thereby leaving the upper heddle lever in a position to be struck by the evener when moving inwards. In consequence of this difficulty it became necessary for an operator to keep his hand continually upon the shipper which threw the loom into and out of gear, so that the loom could be stopped the moment the jack escaped from the elevator. The running of the loom also was accompanied with a great deal of jar, arising from the fact that the spring catches are necessarily set a little within the extreme range of motion of the jacks for the purpose of ensuring their passage under the upper and over the lower shoulders; hence, at every operation of the elevator and depresser the inner shoulders of the prongs of those jacks which were held by the catches were struck with a jarring blow by the elevator and depresser. The experiments showed that the loom could not be run practically at more than about half the speeed of other looms running upon the same kind of work. The experiments also showed that the loom could not be run practically without the evener, because, when so run, the movement of the shuttle through the shed was stopped by the sudden ascent and descent of the warp threads appertaining to the heddles whose jacks were disengaged from the catches for the purpose of being shifted. The tension of the warp threads acting upon the jacks caused them to move much faster than the elevator and depresser until the warp threads attained about their central positions; and as the evener was not in the loom to control this movement, the warp threads closed so suddenly upon the shuttle as to stop its movement almost every pick, and if the shuttle had been driven with sufficient violence to force it across the loom, the warp threads would either have been broken, or the pattern of the weaving would have been disfigured by the passage of the shuttle over or under the warp threads.

Int. 19. State whether or not in the loom described in said reissued patent, the evener is or is not a part of the necessary mechanism for forming and shifting the shed.

92 Ans. It is, and the experiments which were made on the practical loom before referred to by me proved conclusively that it is so.

Int. 20. State whether or not, in the loom described in said reissued patent, the evener has or has not any agency, and, if so, what, in holding the jacks in their elevated and depressed positions.

Ans. It has, as before stated by me.

Int. 21. State how many looms in all you ever saw constructed, as set forth in said reissue, in respect to the combination for forming and shifting the shed.

Ans. But one; namely, the one referred to as seen at the Arlington Mill.

Int. 22. Please state whether or not you have seen in practical operation any looms constructed in conformity with Model B, so far as concerns the mechanism thereby represented. If yea, when and where, and in whose presence did you witness the practical operation of the same, and whether or not the concentric portions of the cam slots were removed in any of the sectors, and state what the operations were that you witnessed.

(Objected to.)

Ans. I have seen a large number of looms in practical operation with the mechanism constructed like that represented by Model B, as far as it goes, and with the other mechanism necessary to weave practically. The first time I saw such looms was about two years ago, at the Wash-

ington Mills at Lawrence, in presence of Mr. Joshua D. Ball and Samuel T. Thomas, and some employees of the mill, whose names I do not know. Since that date I have seen about thirty of said looms at the Arlington Mill, when Robert Davis, Leonard Pearce, Samuel T. Thomas, Joshua D. Ball, Francis C. Treadwell, jr., and others, were present. The time at which those persons were all present was Wednesday, the 29th of August, 1866. I also saw at the last time mentioned, and at the same place, and in presence of the same persons, two looms with mechanism in all respects like that represented by Model B, except that there were no concentric portions upon the cam slots, whose harnesses were in operation, namely, four in one loom and eight in the other. I noticed that, in a majority of the looms which were running with slots having con-
concentric portions, the friction-wheels on the side of the T-levers of the heddles did not enter the said concentric portions at the upward strokes of the jacks, and that such looms worked just as well as
93 the other looms. I also saw the experiment tested of removing the brakes from the sectors of the looms, and noticed that in such case the jacks were not held in the uppermost positions in which they were moved by the elevator, although they were previously moved far enough to cause the concentric portions of the slots to act upon the friction rollers of the heddle levers. In such case, the concentric portions of the slots were moved backwards by the partial descent of the jacks, so that the friction rollers rested upon the inclined portions of the slots. I also noticed that in weaving light goods without the brakes, and with slots having the concentric portions, the warp threads, although partially moved by the change in the position of the jacks, so that the concentric portions were not acting, were not moved sufficiently to prevent the passage of the shuttle.

Those looms which had cam sectors without any concentric portions to the slots worked just as well as those having cam slots with concentric portions, both on light and heavy goods.

I found that, when the brakes were removed from looms having cam sectors with concentric portions in the cam slots, the jacks, when moved down to their lowest positions, were held there by the counterpoise weight cast upon the sectors, so that the friction rollers were thus in the concentric portions of the cam slots nearer the centres of the sectors, and I found by moving the parts of the loom by my hand that this weight was the only thing, other than the mere friction of the loom, that then held the jacks.

Int. 23. Please state whether or not you can produce one of the cam sectors which you saw operated in the loom, as stated in your last answer, without the concentric portions in the slots. If so, please produce and identify the same as part of your deposition.

(Objected to.)

Ans. I produce one of the cam sectors taken from the broad loom, weaving heavy goods, being one of those without the concentric portions in the slots. It is marked, Defendant No. 1, R. E. S., Examiner, &c.

Int. 24. Please state in what condition said cam sector is, as compared with the time when you saw it operated in said loom, and who took it from said loom, and where has it been since.

94 Ans. It is in the same condition now that it was when it was operated in the loom. It was taken out of the loom in my presence, and handed to me, and has been in my possession ever since that time.

Int. 25. Please state whether or not any and, if any, what alteration was made in the slot in said sector before you saw it operated in said loom.

Ans. The concentric portions of the slot as originally constructed were cut out, and the small pieces of metal seen in the exhibit were inserted, so as to remove entirely the concentric portions of the slot. The same alteration was made in the other seven cam sectors of the loom that were used in weaving.

Int. 26. Please examine the exhibits marked, respectively, Defendant No. 2, R. E. S., Examiner, &c., Defendant No. 3, R. E. S., Examiner, &c., and Defendant No. 4, R. E. S., Examiner, &c., being the patent granted to Samuel T. Thomas, 3d July, 1855, No. 13187, for improvement in looms, and the patent granted to him February 11th, 1862, No. 34381, for improvement in fancy looms, and the specification and drawings of the patent granted to said Thomas, and Edward Everett, March 16, 1852, No. 8810, and state whether you have previously examined the same, and state whether or not you find any and, if any, which of the mechanism recited in the claiming parts of said patents in the looms represented by said Model B.

Ans. I have previously examined the said patents. I find in Model B a representation of the mechanism recited in the first and second claims of patent No. 13187, and in the claim of patent No. 8810.

Int. 27. Please detail what mechanism in the loom represented in Model B you find referred to in the claiming parts of said patents.

(Objected to.)

Ans. I find the combination of each heddle lever, or rocker lever, and the lifter or jack thereof, with a projecting arm, a cam or cam slot, and sector, all being applied together, and made to operate in the manner described in patent 13187. I also find the combination of the series of jacks, or lifters, and the pattern prism with a series of bent levers for imparting to the pattern prism vertical or up-and-down move-
95 ments, as described in the same patent. I also find in the pattern chain of said model a combination of the buttons with the metallic cards—the buttons being so rivetted to the cards to allow the former being turned for the purpose of closing or opening the holes of the cards, as described in patent No. 8810.

Int. 28. How with reference to the mechanism referred to in the claiming parts of said patents, mentioned in the twenty-sixth interrogatory, were the Thomas looms constructed which you saw operated?

(Objected to.)

Ans. I noticed that all of the said looms were constructed with the mechanism referred to in the first, second, fourth, fifth, sixth, and seventh claims of patent No. 13187, and that one of them contained the mechanism referred to in the third claim of that patent, and others had the arrangements required to permit the use of that mechanism. I also noticed that all of the said looms which I saw were constructed with the mechanism referred to in the second and third claims of patent No. 34381. I did not notice whether the said looms did or did not contain the mechanism referred to in the first and fourth claims of patent No. 34381. All the said looms which I saw were constructed with the mechanism referred to in the claim of patent No. 8810.

Adjourned to 10 a. m., the 4th inst.

SEPTEMBER 4.

Int. 29. State what are the advantages, if any, of the pattern mechanism shown in Model B, as compared with the pattern mechanism in Model A.

Ans. The pattern chain of Model B can be adjusted to vary the pattern woven without taking it out of the loom, and with great rapidity,

and it does not require the removal or replacement of any members; for the buttons or covers of the holes which are not operating remain fast to the cards, in convenient positions to be brought into action when the pattern of the weaving is to be changed. The pattern chain of Model A requires to be removed from the loom, or disengaged, in order that the cams may be changed, and either other cams applied, or the cams upon it be adjusted and secured in new positions.

96 Int. 30. Please state whether or not you find the brakes on the cam sectors and the concentric portions in the slots of the sectors shown or represented in any of the patents mentioned in the twenty-sixth interrogatory.

Ans. I find them all shown in patent No. 13187, although the brakes in that patent have not the same form as those shown in Model B, the shoe being omitted in the drawings of the patent, and the spring bearing directly upon the rim of the cam sector. In patent No. 34381, the cam sectors having concentric portions in their grooves, are shown, and also the brake shoes, and there is also a line representing the spring bearing upon the brake shoe.

Int. 31. State how with reference to their extreme elevation or depression were the heddle leaves during the operation of the loom, like Model B, which you saw operated at the Arlington Mills, with the concentric portions of the slots in the cam sectors removed.

Ans. The heddle leaves were raised and depressed to the limits of their ranges of motion by the operation of the jacks, the same as in other looms having concentric portions in the slots of the cam sectors, when the friction wheels were moved into the concentric portions, and the heddles, when so raised and depressed in the said loom, remained in their positions until their jacks were again moved by the elevator and depresser.

Int. 32. State whether or not the slot, or any part of the slot, in defendant's Exhibit No. 1, now contains, or contained at the time you saw it operated in the loom, any concentric part or portion.

Ans. It does not now, and it did not then.

Int. 33. How were the other sectors which you saw operated in that loom at the same time you saw the sector produced by you worked in it, as compared with the slot in the sector so produced by you?

Ans. They were like it, having no concentric portions in their slots.

Int. 34. State whether or not, in your opinion, the loom described in said reissued patent is practically valuable for weaving purposes, as compared with other looms previously in use.

(Objected to.)

Ans. In my opinion it is not.

97 Cross-examined by Causten Browne, esq., counsel for complainants:

Cross-int. 1. Do the pattern chains in both the loom represented by Model A, and that represented by Model B, cause, by their shape and motion, the oscillation and selection of jacks?

Ans. They do, as I have already stated in my direct examination.

Cross-int. 2. In both looms do the elevators lift, and the depressers depress, the jacks, so as to carry the heddles from their extreme upper positions to their extreme lower positions?

Ans. They do, as I have already stated in my direct examination.

Cross-int. 3. In both looms do the chains have protuberances and depressions, substantially?

Ans. In the loom represented by Model A, the pattern chain has what may properly be called protuberances and depressions, because the

protuberant parts project further from the axis of the barrel of the chain than the other portions. In Model B, the covers of the holes might be improperly called protuberances, but, in point of fact, they do not project as far from the centre of the prism as the edges of the card to which they are attached, and if the chain was turned in contact with an article to be moved by it, as the chain of Model A is, the covers, or buttons, would not move the article as far from the centre of the prism as the edges of the card plates would. The holes of the pattern chain of Model B are holes which permit an article to pass through the chain, and are not depressions.

Cross-int. 4. Is there, in the loom represented by Model A, a succession of protuberances, or a succession of depressions, so long as a particular jack is to be held either up or down?

Ans. There is.

Cross-int. 5. Is there, in the loom represented by Model B, a succession of covers, which you think might be improperly called protuberances, or a succession of holes, so long as a particular jack is to be held either up or down?

Ans. There is.

Cross-int. 6. Are there, in each loom, two notches, or shoulders, on each jack, for the elevators and depressers to act upon?

Ans. There are, as I have already stated in my direct examination.

98 Cross-int. 7. Is there, in the loom represented by Model B, a weight to shove the desired jack outward or away from the loom?

Ans. There is, in the loom represented by Model B, one weight for each jack, to move it outward from the loom, and a second weight for each jack to move it inward.

Cross-int. 8. Is there shown in the drawings of the Thomas patent, No. 34381, a spring, in place of this weight, to shove each jack outward or away from the loom?

Ans. There is.

Cross-int. 9. Is there, in the loom represented by Model A, a spring to throw each jack outward or away from the loom?

Ans. There is no special spring in that model for that purpose, but the strain of the connecting mechanism, by reason of the construction of that mechanism, and its combination with the jacks moves them outwards when the pattern chain will permit, in manner like a spring.

Cross-int. 10. In both looms, as represented by these models, does the motion of the elevators and depressers, acting through the jacks, move the heddles to alter the shed?

Ans. In both looms, the elevators and depressers, acting upon the jacks, move the heddles to alter the shed, but, in the loom represented by Model B, the entire movement of the heddles and jacks is effected by the elevators and depressers, while, in the loom represented by Model A, the first portion of the movement of the heddles and jacks is effected by the tension of the warp threads under the control of the evener, while the latter part of their movement is effected by the elevators and depressers.

Cross-int. 11. What proportion of the movement of the jacks from their extreme positions towards their mean positions can you say is performed before they are engaged by the elevator and depresser?

Ans. From observation of the Marshall loom which I saw operated, I should say that nearly, or quite, the whole of the movement of the jacks from their extreme to their mean position is performed before the elevator and depresser catch up with the jacks, and engage with their shoulders.

99 Cross-int. 12. Is the operation of the evener which you have just mentioned the same that you referred to when you said, in answer to the 7th direct interrogatory, that the evener also performed an important function in the combination by assisting in shifting the shed?

Ans. It is the same as that referred to in the portion quoted in the present question, and the portion which follows in the answer referred to.

Cross-int. 13. Is there any duty performed in the loom, represented by Model B, by the pressure of the friction brakes upon the sectors between the time when the sectors begin to move, and the time they come to rest?

Ans. There is. The friction brakes exert a constant pressure upon the cam sectors, and exert a continuous retarding force to their movement. Hence they prevent the jacks from moving downwards under the action of the counterpoise weights on the sectors, and the strain of the warp threads (if they overbalance the weight of the harness) more rapidly than the depresser, and thus prevent the premature closing of the warp threads, and the jar that would be occasioned by the depresser striking the shoulders of the jacks when the depresser was in rapid movement. In cases where the tension of the warp threads, coupled with the weight of the harness, is more than sufficient to counterpoise the counterpoise weight on the sector, the brakes perform the same duty and accomplish the same useful result in reference to the jacks which are being raised.

Cross-int. 14. Could not the pattern chain and the front-weighted levers be taken out of the loom represented by Model B, and the pattern chain in the loom represented by Model A be substituted therefor, and the loom work, supposing motion at the proper time to be imparted to the chain thus substituted?

Ans. It could, and the loom would work under the supposition stated in the question.

Cross-int. 15. Do you think that the loom represented by Model B would then contain a substantially different combination from that which it contained for forming and shifting the shed, before such substitution was made?

Ans. The construction of the other members of Model B is such as to permit of such substitution without changing the mode of operation of any one of them; and if the combination existing in that loom be considered to embrace any pattern mechanism capable of performing the functions which the pattern mechanism of that model performs without requiring a change in the other members, I should say that the substitution supposed would not make the mechanism for forming and shifting the shed in that loom substantially different from what it was before such substitution. But it must be kept in view that in making the change supposed, the pattern chain of Model A takes not only the place of the pattern chain of Model B, but also of the outer series of weighted levers, and of the mechanism for imparting a reciprocating movement to the pattern chain, and if the combination for forming and shifting the shed in Model B is limited to the combination of parts which are required in that model, with the pattern chain that is in it, then the substitution proposed would make a substantial change in the combination.

100

Cross-int. 16. Will you examine the certified copy now shown you of an American patent granted Oct. 30th, 1849, to Henry Bachofner, and marked Complainant's Ex. C, and say whether you find there shown or described a pattern chain mounted upon a prism, having a reciprocating vertical motion to act upon pins attached to weighted bent levers for

the purpose of distributing jacks, in combination with a lifter and depresser?

(Objected to.)

Ans. I have examined the patent, and I find represented or described therein the instrumentalities recited in the question, but the weight of the levers is not made use of to move the jacks. The levers transmit the movement of the pattern prism and chain directly to the jacks.

Cross-int. 17. Is the pattern chain in Model A the same in construction as that used in the old Crompton looms so called, before the Marshall patent, or described in the old Crompton patent of November 25th. 1837?

Ans. It is.

Cross-int. 18. Are the elevator and depresser in Model B the same in construction and operation as those described and shown in the said Crompton patent excepting in the range of motion?

Ans. They are.

Cross-int. 19. Are the jacks in Model B, with the exceptions of
101 the racks formed on their lower ends, the same, and combined in the same manner with the lifter and depresser as in the said Crompton patent?

Ans. With the exception mentioned in the question, they are substantially the same, but are combined with the elevator and depresser by different means; being combined with those by means of the weighted levers, controlled by the pattern chain, while in the Crompton loom the combination with the elevator and depresser is effected by the cams of the pattern chain, and the tension of the connecting mechanism between the jacks and the leaves of heddles. The combination with the elevator and depresser is also different from that found in the Crompton loom in the respect that in Model B the same elevator or depresser moves the jacks through their entire range of motion, while in the Crompton loom the combination is such that the tension upon the warp threads moves the jacks nearly or quite one-half of their movement, such movement being controlled by the elevator or depresser that is engaged with the jack, while the remaining half of the movement is effected by the other depresser or elevator (as the case may be) from that which was engaged with the jack to control the first portion of its movement.

Cross-int. 20. Could not the pattern chain be taken out of the loom represented by Model B, and the pattern chain in the loom represented by Model A be substituted therefor (the pins on the weighted front levers in Model B being taken off), and the loom work, supposing motion at the proper time be imparted to the chain thus substituted?

Ans. If a rotary motion were given to the pattern chain taken from Model A when it was put into Model B in the manner supposed, I think that the loom would not work; for the reason, that from the proportions of the arms of the levers upon which the pattern chain would act, the pattern chain would not, as far as I can judge from an inspection of the model, let a sufficient amount of motion be imparted to the jacks to throw them within the range of the depresser.

Cross-int. 21. Suppose the roller cams on the chain, and the barrel of the chain and its links, to be suitably enlarged, and such chain to be set at a proper relative distance from the jacks, in view of such enlargement, would it then work?

102 Ans. I think it would.

Int. 22. Now please answer the same question, supposing the pins to be left connected with the weighted front levers.

Ans. Then the loom would not work, supposing, as I understand the

question does, that the pattern chain and its barrel have the same motion that they do when in Model "A;" because the pins projecting downward from the lever will obstruct the turning of the cam rollers, and an attempt to turn the pattern chain and its barrel when a lever is down would break the pin of such lever.

Cross-int. 23. I understand you to say, in your answer to the 7th direct interrogatory, that the spring catches hold the jacks during about five-eighths of the revolution of the crank shaft of the loom in their elevated and depressed conditions, and the evener operating in connection with the ends of the upper series of heddle levers operates to hold the jacks in their raised and depressed positions for about three-eighths of the revolution of the crank-shaft. This being so, during what part of the revolution of the crank-shaft does the shifting of the jacks from their raised to their depressed conditions, or vice versa, take place?

Ans. The holding which I spoke of had reference to those jacks which were not being shifted, but were to remain in their elevated or depressed positions during one or more successive picks of the shuttle, while others were being shifted. The jacks which are being shifted are moved while the catches are holding the others, and the evener is not.

Cross-int. 24. In the ordinary working of a fancy loom, has not the shuttle been driven through the shed before the pattern chain moves to determine the pattern for the next pick?

Ans. I cannot say whether it has or has not, as I do not recollect ever having noticed a loom for the purpose of ascertaining the fact inquired of.

Cross-int. 25. From the instant the chain begins to move the jack in Model "A," until the instant when the shoulder of the jack passes beyond the face of the latch, what proportion of the revolution of the crank-shaft takes place?

Ans. About three-eighths.

Cross-int. 26. Is that a sufficient interval of time for the throw of the shuttle?

103 Ans. It may be. I should say from three-eighths to a half of the revolution of the crank-shaft would be accomplished during the passage of the shuttle.

Cross-int. 27. In the loom described and represented in the Marshall reissue, and in the loom Model "A," what proportion of the revolution of the crank-shaft takes place between the instant that the shed is fully opened, and the instant that those jacks which are to be shifted are unlatched for the purpose?

Ans. About five-eighths of a revolution on the average; namely, the whole time that it takes to shift the pattern mechanism, and a little additional time, while the pawl of the pattern chain is moving to engage with the ratchet-wheel.

Cross-int. 28. Do you know who built or superintended the building of the Marshal loom you have mentioned as seen by you at the Arlington Mill?

Ans. I do not. When I first saw it, it was already built, and was being adjusted under the direction of Mr. Samuel T. Thomas.

Cross-int. 29. When was that?

Ans. The first time I saw it was a week from last Saturday, or about ten days ago.

Cross-int. 30. Was this at the Arlington Mills?

Ans. It was.

Cross-int. 31. Was the loom a wholly new one, or an old loom with modifications?

Ans. From appearances I should say it was a wholly new one.

Cross-int. 32. Do you know from information from Mr. Thomas, or from the defendants, by whom, or under whose superintendence, and where, that loom was built?

Ans. I have no recollection of having been told by any one where the loom was built, or under whose superintendence it was built.

Cross-int. 33. How many harnesses did it have in when you saw it operated as testified?

Ans. Four.

Cross-int. 34. Do you know personally, or by information from Mr. Thomas, where that loom has been since you saw it operated, and what, if anything, has been done with it since?

104 Ans. No.

Cross-int. 35. How long did you see it operated?

Ans. I saw attempts made to operate it during portions of four days. It operated best on the last day, and then I saw it operated perhaps altogether for about an hour.

Cross-int. 36. Was it operated at all, to your knowledge or information, before the first of the four days mentioned?

Ans. I don't know. From the message that I got when I went to see the loom, and from some remarks that were made before I saw it, I received the impression that attempts had been made to operate it for some time before I saw it. But if they were no more successful than the first attempts I saw to operate it, it can hardly be said to have operated at all before I saw it, as but portions of it worked successfully, such portions of it being the shuttle mechanism, and others not appertaining to the forming and shifting of the shed.

Cross-int. 37. Do you know, personally or by information, who made, or superintended the making, of the alterations of the sectors of the two Thomas looms with which you have experimented as you have testified?

Ans. As to one of the looms I do not. As to the other loom, which was a broad loom, with eight harnesses working, I know that Mr. Ball gave directions to Mr. Thomas as to the alterations, and that Mr. Thomas took the cam sectors to a machine shop, as I was informed, in Lawrence, and that he afterwards went for the cam sectors and brought them back.

Cross-int. 38. How many Thomas looms in all have you seen in the Arlington Mills since this suit was commenced, say, two years ago?

Ans. The first time that I was at the Arlington Mills was in July last, and from that time to the present I have seen about thirty Thomas looms there. Perhaps a few more.

Cross-int. 39. Have you seen any open-shed looms there, not Thomas looms?

(Objected to.)

Ans. Yes; two. The Marshall loom before referred to, and another loom.

Cross-int. 40. Was the last-mentioned loom of the make of Mr. Crompton, the complainant? (Objected to.)

105 (Objected to.)

Ans. I don't know. I did not notice his name upon it, and from remarks that were made, I am led to believe it was made under Mr. Thomas's directions, or from his plans.

(Counsel for the complainant requests the counsel for the defendants to procure authority for the Marshall loom, and the two Thomas looms heretofore mentioned as the subjects of experiment, to be removed from

the Arlington Mill, and set up in some mill not engaged in the use of looms alleged to infringe the Marshal reissue, and to be there operated under the direction of complainant, but in the presence of defendant's counsel and experts, such removal, setting up, and working of the looms, and their return to the Arlington Mills to be at the expense of complainant, and until this is done the complainant's counsel declines to cross-examine in regard to the experiments heretofore testified to.)

Direct resumed by Mr. Ball:

Int. 35. If the pattern chain and prism in the loom represented by Model B, with the front-weighted levers and inner-weighted levers, are taken out of that loom, and put in the place of the pattern chain and barrel in the loom represented by Model A, what would be the result in the operation of the latter loom?

Ans. It would be inoperative, whether the pattern prism, when so introduced into the loom, was operated either like the pattern barrel of Model A, or as the pattern prism is operated in Model B.

Int. 36. Please answer the preceding question, supposing the substitution be of the pattern chain and prism of the loom represented by Model B, without either the front-weighted levers or inner-weighted levers, for the pattern chain and barrel in the loom represented by Model A.

Ans. Then the loom would be inoperative.

Int. 37. Please answer the preceding question, supposing the substitution be of the pattern chain and prism of the loom represented by Model B, with either the front-weighted levers or the inner-weighted levers for the pattern chain and barrel in the loom represented by Model A?

Ans. Then the loom would not operate practically.

(It is here agreed by counsel that this deposition may be com-
106 pleted either in Boston or New York, before any United States commission, or N. A. Parks, esq., of Boston.

Counsel for defendant here gives plaintiff's counsel notice to produce at some reasonable time and place, for the examination of the defendant's counsel and experts, a loom constructed in accordance with said reissued patent, or to inform the defendant's counsel where such loom can be seen, either in the New England States or anywhere else.)

I, R. E. Stilwell, an examiner in the U. S. courts, do certify that the above deposition was commenced before me in the city of New York on the 1st day of September, 1866, and continued before me on the 3d and 4th days of the same month, said witness having been duly sworn, and counsel for the respective parties being present during such examination, and the above agreement was made in regard to the completion of the deposition.

R. E. STILWELL,
Examiner, &c.

BOSTON, *Sept.* 11, 1866.

Examination continued before N. Austin Parks, esq., by agreement.

Direct resumed:

Int. 38. State whether or not, since the adjournment of your examination, you have examined the loom referred to in the 5th direct interrogatory to you. If yea, when and where?

Ans. I re-examined the Marshall loom referred to, at the Arlington Mill, at Lawrence, yesterday, Sept. 10th.

Int. 39. If the pattern chain in Model A be substituted for that in

Model B, and so constructed as to operate therein, state whether it would or not then perform in Model B the same operations as it does perform in Model A, and state your reasons.

Ans. It would not. The pattern mechanism in Model B performs the function only of selecting such jacks as are to be moved for
107 the purpose of moving the heddles; and if the pattern mechanism of Model A were substituted in its place, and such changes made as would enable it to operate, it would perform the same function as the pattern mechanism of Model B, and no other; whereas the pattern chain of Model A not only selects the jacks, but also co-operates with the catches, disconnecting such jacks as are to be depressed from the catches, and permitting such as are to be raised to be disconnected from the catches by the operation of the connecting mechanism. The pattern chain of Model A also holds such jacks as are to be depressed in connection with the depresser, which is a function that is not performed by the pattern chain in Model B. The pattern chain of Model A also holds those jacks which are depressed in positions to engage with the lower series of catches, and permits those which are raised to be held engaged with the upper series of catches by the operation of the connecting mechanism, which functions are not performed in Model B, and could not be performed if the pattern chain of A were put in place of the pattern chain of B.

Int. 40. State whether the brakes in the loom represented by Model B are or are not substantially the same, or have or not substantially the same operation as the evener in the loom represented by Model A, and state your reasons.

Ans. The brakes of Model B are not the same, or substantially the same, as the evener of Model A, but are instrumentalities substantially different from said evener. They have not the same, or substantially the same, mode of operation as the said evener, but have a substantially different mode of operation. The evener of Model A is a reciprocating instrument. The brakes of Model B are stationary. The evener of Model A controls the movement of the jacks and heddles by reason of the motion that is imparted to it, and the inclines on the projecting ends of the heddle levers upon which it operates. The brakes exert a constant frictional pressure upon the portions of the connecting mechanism upon which they act. The evener controls the movement of the jacks during only half of their movement. The brakes exert an equal resistance to the movement of the jacks during their entire movement. The
108 evener must be moved in such manner as to co-operate with the elevator and depresser, and the mechanism which moves the evener must therefore be combined in a particular manner with the mechanism which moves the elevator and depresser. As the brakes have no movement, there is no such co-operation between mechanism for moving the elevator and depresser, and mechanism for moving them. The evener holds the jacks in their elevated or depressed position by opposing a positive obstruction to their movement, and operates, in this respect, like the bolt of a door-lock. The brakes oppose no positive obstruction to the movement of the jacks and the parts connected therewith, but operate, by frictional contact, in the same manner as the brake of a railway car.

Int. 41. State whether or not you find anything in the loom represented by Model B, which is the same, or substantially the same, or has the same, or substantially the same, mode of operation as the evener in the loom represented by Model A.

Ans. I do not.

Int. 42. If you substitute the pattern chain in the loom represented by Model A for the pattern chain in the loom represented by Model B, and make the necessary changes to make the latter loom operate, would you or not then have the same, or substantially the same, combination for forming and shifting the shed in the loom represented by Model B, so altered, as is set forth in said reissued patent?

Ans. You would not. You would have a substantially different combination for the purpose.

Int. 43. State whether or not the loom described in said reissued patent can be so set that the warp threads will not close upon the shuttle during its passage through the shed, supposing that the evener be not used, and please give your reasons for your opinion.

Ans. It cannot. If the evener be not used, the warp threads appertaining to those jacks which are to be moved close by tension the moment their jacks are disconnected from the catches by the operation of the pattern mechanism and connecting mechanism. The jacks must be so disconnected before they can be moved to shift the shed, and
109 the shed must be opened, or, in other words, the shifting must be completed before the shuttle is thrown through the shed. In the Marshall loom, as described in the reissue, about five-eighths of the revolution of the crank-shaft are required to shift the shed, leaving the shed open during about three-eighths of the revolution of the crank-shaft. Now, in the said loom I find, by experiment, that the passage of the shuttle through the shed occupies, as near as may be, half of the revolution of the crank-shaft, consequently the jacks must be disconnected from the catches by the operation of the pattern mechanism, and the movement of the jacks for shifting the shed for the next pick must commence before the shuttle completes its passage, in order that the shed may be opened in time for the shuttle at the next pick. As this disconnection from the catches takes place before the passage of the shuttle is completed, the warps will be closed upon the shuttle by their tension, if the evener be not in the loom to prevent such closing at that time. The set of the cams, which operate the shuttle relatively to the mechanism for operating the shifting of the shed, cannot be changed practically, because, if the shuttle was thrown sooner, the shed would not be opened to let it enter; and, if thrown later, the difficulty arising from the absence of the evener would be aggravated. The difficulty in the loom arises from the fact that the mechanism for shifting the shed requires about five eighths of the revolution of the crank-shaft, while the passage of the shuttle requires half a revolution, or four-eighths, making nine-eighths, if the two did not overlap; whereas, as there are only eight-eighths of a revolution to do the work in, the movement of the shed-shifting mechanism must of necessity overlap the movement of the shuttle, and if the evener be not in the loom to control the movement of the shed-shifting, the warp threads will necessarily close by tension upon the shuttle. When the evener is in the loom, although the warp threads begin to close before the passage of the shuttle is completed, the evener prevents them from closing sufficiently to produce any practical effect upon the movement of the shuttle.

Int. 44. State how the time of throwing the shuttle relatively to the operation of shifting the shed in the Marshall loom seen by you corresponds with the time of throwing the shuttle relatively to the
110 operation of shifting the shed in the loom described in said reissued patent.

Ans. It is the same in both looms, the shuttle being thrown as soon as the shifting of the shed is completed, so that the shed is open.

(It is agreed by counsel that the copy of the reissued patent which Mr. Renwick examined, as stated in his answer to 4th direct interrogatory, was a duly certified Patent Office copy of said reissue patent.)

Adjourned to 14th, at 10 a. m.

Cross resumed by C. Browne, esq.:

Cross-int. 41. Look at the model now shown you, and marked "Complainant D," in which there are depressions formed in the periphery of the sector for the friction brake to drop into when the sector is at its two extremes of motion, and suppose Model B had all its sectors made like that shown in this model "D," would Model "B," when so altered, have substantially the same combination that it now has for forming and shifting the shed?

(Objected to.)

Ans. In the model now presented to me the rim of the cam sector has in it two slight depressions which are connected with the concentric portion between them by two inclines, which permit the brake shoe to traverse readily from the depression to the middle concentric portion and into the other depression without requiring the disconnection or removal of the brake shoe from the part on which it operates, or the liberation of the cam sector from it. The result of this arrangement is, that if the same pressure were applied to the brake shoe of a loom constructed with such a cam sector as is applied to one constructed as represented in Model "B," a greater amount of force would be required to move the jacks. Hence, in order to make a loom operate practically with cam sectors constructed as in Model "D," a less amount of pressure must be applied to the friction brakes than is applied to the friction brakes of a loom constructed exactly like Model B. But inasmuch as the slight depressions in Model D are connected with the portion between them by easy inclines, which simply increase the friction to the movement
111 without obstructing it, as a stop or catch would, I think that making the cam sectors of Model B like that of Model D would not change in substance the combination of mechanism existing in Model B for the purpose of forming and shifting the shed.

Cross-int. 42. Since you were cross-examined in New York, have you ascertained, by information from the defendants, or from Mr. Samuel T. Thomas, where, or by whom, or under whose direction, the so-called Marshall loom, now at the Arlington Mills, Lawrence, was built?

Ans. I heard a conversation yesterday, from which I understood that it was built at Laconia. I have not heard nor been informed by whom it was built. I have heard that Mr. Thomas gave directions to have it built, and I have heard that Mr. Ball, of counsel for defendant, requested that it might be built.

Direct resumed:

Int. 44. Please state whether or not the complainant's counsel and any, and if any which one, of his experts and the complainant himself and Moses Marshall visited the Arlington Mills, at Lawrence, yesterday, and whether or not they examined any, and which, of the looms there which you have referred to in your deposition in this case, and whether or not defendant's counsel made any and what offer at that time as to operating or permitting the complainant, or his counsel, or any of his operators, to operate the same, and what the complainant or his counsel did in reference to the offer.

Ans. Mr. Browne, complainant's counsel, Mr. Henry B. Renwick, one of his experts, Mr. Crompton, complainant, and a gentleman whom I understood to be Moses Marshall, visited the Arlington Mills, at Law-

rence, yesterday. They examined the Marshall loom, to which I have referred in my answer to 5th direct interrogatory, and some others, and the narrow Thomas loom, having cam sectors without concentric portions to their slots, and to which I have also referred in my deposition. Defendant's counsel offered to have the said narrow Thomas loom and the broad Thomas loom, to which I have referred as without concentric portions in the slots of the cam sectors, operated for the party, or
112 to permit them or any of them to operate them. He also offered to permit them to operate the said Marshall loom. Mr. Browne, complainant's counsel, declined to see the Thomas looms operated, or to operate them, or the Marshall loom.

E. S. RENWICK.

BOSTON, *Sept. 14th*, 1866.

113 *Exhibit No. 2.—R. E. S., Examiner.*

No. 13187.

The United States of America to all to whom these letters patent shall come:

Whereas Samuel T. Thomas, of Lawrence, Mass., has alleged that he has invented a new and useful improvement in looms, which he states has not been known or used before his application; has made oath that he is a citizen of the United States, that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said Samuel T. Thomas, his heirs, administrators, or assigns, for the term of fourteen years, from the third day of July, one thousand eight hundred and fifty-five, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Thomas in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

114 Given under my hand at the city of Washington, this third day of July, in the year of our Lord one thousand eight hundred and fifty-five, and of the independence of the United States of America the seventy-ninth.

ROBERT McCLELLAND,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[SEAL.]
C. MASON,
Commissioner of Patents.

The schedule referred to in these letters patent and making part of the same.

To all persons to whom these presents shall come;

Be it known that I, Samuel T. Thomas, of Lawrence, in the county of Essex, and State of Massachusetts, have invented an improved loom for

fancy weaving, and I do hereby declare that the same is fully described and represented in the following specification, and the accompanying drawings, letters, figures, and references thereof.

Of said drawings—

Fig. I denotes a top view of my improved loom.

Fig. II a front elevation of it.

Fig. III an elevation of the right end of it.

Fig. IV an elevation of the left end of it.

Fig. V a rear elevation of it.

Fig. VI is a vertical and longitudinal section of it, the same being taken through the cam shaft C, to be hereinafter described.

Fig. VII is a transverse and central section of such loom, it being taken so as to exhibit the parts on the left of the plane of section.

Fig. VIII is a vertical and longitudinal section of the cam shaft C, and the cam for operating the shuttle-boxes.

Fig. IX is a vertical and transverse section of the detached balance wheel, and its friction clutch-wheel, to be hereinafter described.

115 In the drawings, A is the main frame of the loom; B is the main driving shaft; C, the cam shaft; D, the lay; E, the breast beam; F and G, two series of movable shuttle-boxes (applied to opposite ends of the race beam); and H H H are the harnesses or bars to represent them, the front two harnesses or bars being employed for the plain selvedge or stripe weaving, while the others are for fancy weaving. Each of the said harnesses is supported by four cords I I, two of which extend vertically, and are made to pass against, and horizontally over, two friction sheaves or pulleys K^1 K^1, arranged at the upper part of the loom, as seen in the drawings. From thence these cords are united or fastened to the upper end of one of a series of rocker levers L L, disposed as seen in Figures 1, 2, and 6, the lower arm of said lever being fastened to two other cords 1^1 1^1, which pass horizontally from and under and against pulleys K^2 K^3, and thence up to the harness. Each harness, by such an arrangement of pulleys and cords, is caused, when its rocker is moved upon the fulcrum M thereof, to play in a vertical plane. From each rocker lever L an arm N extends, as seen in Figures 2 and 6, and carries a projection or friction roller, which extends into a cam groove *a*, made in a rocker sector *o*, arranged and made to turn on a fulcrum or shaft P, as seen in the drawings. The periphery of this rocker sector is serrated, and engages with a toothed rack *b*, formed upon the lower end of the lifter or bar R, arranged and formed as seen in Figures 1, 4, and 6. The series of lifters R R operates in connection with an elevator S, and a depresser T, which are bars projecting respectively from two vertical sliding shafts V W, disposed as seen in Figures 1, 4, and 5.

A reciprocating movement is imparted to each of the shafts V W (they, at the same time, being moved in opposite directions) by means of cranks and connecting rods, arranged as seen at X Y and Z Q, in Figures 2, 4, and 5. A horizontal shaft *c* carries the said two cranks X Y, and is driven by two gears *d e*, applied to it and the main driving shaft, as seen in the drawings, and particularly in Figure 4. Each of the lifters R has applied to it a bent lever *f*, as seen in Figure 6, said bent lever being made to play vertically upon a horizontal pin or

116 fulcrum *g*. The lower or the shorter arm of said lever rests against the lifter, or is borne against it by the gravitating power of a weight *h*, or the equivalent thereof, fixed to the longer arm. There is a small pin or stud *i* projecting from the longer or horizontal arm of each lever *f*, the series of pins being made to operate in connection with

a Jacquard prism *k*, and a pattern card chain *l*, which are arranged as seen in the drawings, and are moved either upwards or downwards, so as to carry them either towards, or away from, the series of levers, as occasion may require. Such movements of the pattern prism may be effected by means of any suitable mechanism, that which I employ consisting of a horizontal rocker shaft, which sustains the journals of the pattern prism by means of arms *n n*, and has a third arm *o*, projected backward from it (as seen in the drawings), and jointed to the upper end of a connecting rod P, whose lower end is jointed to a crank *q*, fixed upon the end of the main driving shaft B. By means of the Jacquard pattern prism and card (which may be put in rotation by any suitable mechanism, and operated at proper periods), the series of bent levers *f f*, the series of lifters R R, the series of reciprocating rocker sectors *o o*, the cams *a*, and the arms N N of the rocker levers L L, the movements of the harnesses are regulated so as to dispense with a great deal of unnecessary motion to which they are subjected in most other fancy looms, and which has a tendency, not only to produce a wear of them, but a corresponding wear of the warps.

The mechanism in other fancy looms is so constructed as to close all the warps together at or during every beat of the lay, and previous to the elevation and depression of such of them as were to be employed for the next throw of the shuttle. This movement or mixing together of all the warps is not effected by or in my machine, for those warps which have been either elevated or depressed are maintained stationary, either up or down, as the case may be, when the lay beats up. Each warp thread will thus remain stationary until it becomes necessary to move it, and no matter what may be the number of the beats of the lay in the interim.

By such a mode of operating the harnesses, and maintaining them at rest, much wear of them and the warps is prevented, such a result being effected by the employment of the rocker sector, and its 117 grooved cam in connection with the arm of the rocker lever, and with the lifter, substantially in manner as set forth.

I would also observe that, not only by combining with the pattern prism and the lifters, the bent levers, arranged with respect to the same, as above described, but by giving to said pattern prism, vertical or up-and-down, instead of horizontal, motions (as pattern prisms of a Jacquard apparatus are generally operated), a very important result is effected, for, when a pattern prism is moved horizontally in the usual way, it is found very difficult to maintain the working leaf of the cards in contact with the working face of the prism, as both face and leaf stand in vertical, or nearly vertical positions. Such positions of them require a bar or some other contrivance, so applied to the pattern chain as to keep it in contact with the working face of the prism; otherwise, the wires are liable to miss their hold of the pattern card, and produce a false movement of the harnesses or warps.

In my improved loom the gravitating power of the pattern chain is employed to maintain its working leaf in close contact with the working face of the pattern prism, which is always uppermost. In order that the lifters may operate to advantage, I arrange each of them at a slight inclination from the vertical, and in a direction towards its bent lever *f*. Under such an arrangement of the lifter, its gravitating power will generally be sufficient to effect its movement in a direction towards the lever, whenever occasion may require; but, in case such gravitating power may not be sufficient to produce such an effect, particularly when the loom is running at high speed, a small spring may be applied to

each lifter so as to insure its movement in the direction required. The cords of each of the front two harnesses are led around guide pulleys *r s*, and vertically towards, and are fastened to, the end of one of two levers *t u*, see Figures 1, 2, and 7, these levers, at their rear ends, turning vertically upon a fulcrum U. Each of said levers is moved in a vertical plane by means of a cam W^1 or X^1, fixed upon the cam shaft C, said cam shaft being made to receive its motion from the main driving shaft by means of a train of gears *y* and *z*. See Figures 1, 3, and 5.

Each of the cams W^1 and X^1 is formed with a cam groove made in one side of it, and for the purpose of receiving a stud or friction
118 roller projecting from the lever *t* or *u*, immediately adjacent thereto. The cam has a continuous rotary motion imparted to it, its groove being so formed as, during such, to give to the lever such an upward or downward motion, and interval or intervals of rest, as may be necessary to insure the correct operation of the harness.

In the mechanism last described, only one lever and cam are employed to operate a harness, whereas, by the ordinary method of moving a harness with treadles and a cam, two treadles and two cams become necessary.

Each set F G of movable shuttle-boxes hereinbefore mentioned is sustained upon the upper end of a rod a^1, which is supported so as to slide freely upward and downward, and is connected to a lever c^1 by means of a link b^1 jointed to both. The said lever c^1, at its rear end, is jointed to another lever d^1, and near the fulcrum e^1 thereof, as seen in Figures 3 and 4. The lever d^1 has vertical movements imparted to it by means of a star cam f^1, which turns upon a long horizontal shaft g^1 extending through both ends of the loom. Between the two levers c^1 d^1 is a wedge h^1, which is affixed to one side of a slide bar i^1, which slides freely in bearings fixed to the lower lever d^1.

Against a projection k^1, from the inner side of the slide bar i^1, a stud l^1, extended from a lever m^1 or n^1 (see Figures 5 and 6), is caused to bear one of these levers, viz., m^1, or that situated at the right end of the loom, turns freely on a horizontal shaft o^1, the other lever n^1, or that situated at the other end of the loom, being affixed to said shaft. Thus it will be seen that one lever operates independently of the other.

In Figure 10 I have exhibited a top view of the mechanism that is situated below the main driving shaft B, and on the left end of the loom, and in this view, as well as in Figure 2, are shown two star cams p^1 q^1, which are shaped precisely alike, one of them being exhibited in side view in Figure 11. These cams are also represented in Figure 8. They are for the purpose of operating the levers m^1 n^1. The periphery of one of them, viz., p^1, rests against an arm r^1, projecting from the lever n^1, while the periphery of the other cam q^1 works in contact with a curved arm s^1, fixed to and extending from the shaft o^1. Each of the con-
119 tinuous star cams f^1 p^1 q^1, on the left side of the machine, revolves freely on its shaft g^1 and has a friction pulley or barrel t^1 affixed to one side of it, there being a friction brake or strap n^1 extended around and against the periphery of the barrel, and serving to maintain the star cam in any position into which it may be turned by its pawl and ratchet, each of said continuous star cams being provided with a ratchet, as seen at w^1 x^1 y^1. Besides the ratchet above mentioned, there is another ratchet z^1, which is fixed upon the shaft g^1, and is for the purpose of putting said shaft in rotation. The several ratchets are respectively furnished with sliding impelling pawls a^2 b^2 c^2 d^2, which are arranged as seen in Figures 4 and 10, each pawl being provided with a standard e^2, which rises above the pawl, and in front of the lower arm

of a rocker lever f^2, whose upper arm rests in contact with the periphery of a cam g^2, fixed upon the cam shaft C. To each pawl there is also applied a retractive spring h^2, the rear end of each pawl being provided with a notch or shoulder, as seen at i^2, which is intended to operate in connection with one of a series of upright and bent wires k^2, which are supported so as to slide freely in vertical directions through guides l^2 m^2. The upper parts of these wires are curved semi-circularly, and operate in connection with a pattern prism n^2, and pattern card chain o^2, arranged as seen in the drawings. The shaft of this pattern prism projects vertically from a slide rod p^2, from which an arm q^2 extends towards, and rests upon, a cam r^2, fixed upon the driving shaft. This cam serves to elevate the slide rod and its pattern prism, while a spring s^2, fixed upon the rod, and bearing against a projection t^2, through which the rod slides, serves to depress said rod and said pattern prism.

Whenever any one of the wires k^2 drops into a hole of its pattern prism, its lower end will be so carried below the top of the shoulder i^2 of its pawl, as to prevent said pawl from being retracted by its spring, and carried into contact with the rocker lever f^2. During the rotation of the cam g^2, such of the impelling pawls a^2 b^2 c^2 d^2, as may have their posts or standards in contact with the rocker lever f^2, will be driven forwards and will turn their ratchets so as to rotate their respective star wheels, the order or periods of such rotation being governed by the pattern prism and its chain o^2.

120 The above-described machinery not only causes each series of shuttle boxes to be operated independently of the other, and so that it may be moved to any desirable extent while the other is either stationary or put in movement, but it serves to cause either of the series of shuttle boxes to be moved (whenever such may be necessary) double the distance of the other in the same length of time. This latter movement of either series of shuttle boxes is produced by its star cam f^1, and the wedge h^1 over the same, the said wedge during the time the star cam is elevating the lever d^1 being forced or moved between said lever d^1, and the lever c^1, over it, so as, in connection with the star cam to produce a compound movement of the lever c^1, and the series of shuttle boxes immediately connected with it.

My improvement enables me to use five shuttles in two series of boxes, in which there are three boxes in each series, whereas, where two such series of shuttle boxes are so connected by mechanism, that their movements in opposite directions are alike, the movement of the one being dependent on that of the other, and controlled by the same mechanism, only three shuttles could be employed in them. Thus it will be seen that my method of operating the two series of shuttle boxes by two mechanisms independent of one another, and controlled by one Jacquard apparatus situated at one end of the loom, possesses an important advantage comparatively speaking.

On the main driving shaft B, there is placed a fly or balance wheel u^2, it being so applied to the shaft as to be capable of free rotation thereon, such balance wheel and the friction clutch wheel with which it acts, is shown in section in Figure 9. The latter wheel v^2, is fixed firmly to the main shaft, and has a conical surface or periphery w^2, which extends from it and enters a corresponding recess x^2, made within the balance wheel.

The neck of the balance wheel is provided with a groove y^2, which extends around it, and receives a forked rocker lever z^2, (see Figures 1, 2, and 3), the fulcrum shaft of said lever being supported by two struts a^3 a^3, projected from the end of the framework. The shaft b^3, of the

shipper c^3, is connected with the rocker lever z^2, by means of a third rocker lever d^3, and so that when the shipper moves towards its
121 holding notch or shoulder e^3, it shall cause the detached balance or fly wheel to be moved towards and against its friction clutch wheel, a spring f^3, upon the shaft of the shipper serving to produce a contrary movement of the fly wheel when the shipper is thrown off its shoulder. The detached fly wheel may not only serve as a fly but also as a pulley for the driving belt of the loom to run upon.

The object of having a fly or balance wheel applied to the loom in the above-described manner is to enable the loom whenever it is set in motion to be started with a force sufficient to throw the shuttle with certainty across the race beam, which cannot always be effected where the loom is to be put in operation by slipping the driving belt from a loose to a fast pulley, applied to its driving shaft, and said shaft has a fly wheel fastened to it. A farther object of the detached fly wheel, and the mechanism for moving it on the main shaft is to so separate the said fly wheel from the driving shaft just prior to a stoppage of the loom in order that the loom may be relieved of the momentum of the fly wheel, which, were the motion of the fly suddenly arrested, would not only produce a great and injurious strain on the working parts of the loom, but other disadvantageous results. The friction clutch prevents the momentum of the fly from straining or doing injury to the mechanism set in operation by it.

To the periphery of the friction clutch v^2, a friction brake g^3 is applied, as seen in Figures 1 and 3, such friction brake being provided with a lever latch h^3, which turns horizontally on or in the brake as a fulcrum, and is jointed to an upright lever i^3, whose lower arm is bifurcated and made to straddle a projection k^3, extending from the shipper shaft, the same being as represented in Figure 2. When the shipper is thrown from its notch, the hook of the lever latch h^3 will be moved up against the side of the clutch wheel v^2, and will catch upon a projection or stud i^4, fixed upon the same, as seen in Figure 12, which represents an inner side view of the clutch wheel.

The object of the brake g^3, the latch h^3, and stud l^3 is to prevent the loom from making a false pick immediately after the filling fork
122 or weft stop motion has been put in operation, which otherwise would invariably take place.

Having thus described my improved loom, what I claim is as follows:

I claim combining with each rocker lever L, and the lifter R thereof, an arm N, cam *a*, and sector *o*, or the equivalent or equivalents thereof, the whole being applied together, and made to operate in the manner essentially as specified.

I also claim combining with the series of lifters R R, and the pattern prism *k*, a series of bent levers *f f*, or their equivalents, and imparting to the pattern prism vertical or up-and-down movements, as described, the same being to produce advantages as stated.

I also claim when the upper and lower sets of cords of a harness are supported by pulleys, as described, applying both said upper and lower sets of cords to one and the same end of a lever operated by a cam having a continuous rotation, as described.

I also claim combining with the star cam and lever for moving a set of shuttle boxes, a mechanism substantially as described, for imparting an accelerated movement to the set of shuttle boxes as explained, the said mechanism consisting of the additional lever *d*, the movable wedge h^1, and its operative mechanism, as described.

I also claim the above-described arrangement of a Jacquard, the wires

thereof, the impelling pawls, and the star cams, and their shaft, whereby one Jacquard apparatus, applied at one end of the loom, is made to operate two independent shuttle motions of the loom, as explained.

I also claim so applying to the main shaft a friction clutch wheel, and a fly or balance wheel, that the fly may run loosely upon the shaft, and be capable of being moved either towards or away from the friction clutch, in combination with so connecting the fly with the shipper that the said fly shall be moved laterally during and by the movements of the shipper, as described.

I also claim combining with the friction wheel and the shipper as described, a brake mechanism for throwing said brake g^3 into and out of operation, a specified, such mechanism consisting of the lever latch h^3, the projection l^3, and spring f^3, as specified.

123 In testimony whereof, I have hereunto set my signature this seventh day of April, A. D. 1855.

SAMUEL T. THOMAS.

Witnesses:
R. H. EDDY.
F. P. HALE, Jr.

124 *Exhibit No. 3.—R. E. S., Examiner.*

No. 34381.

The United States of America to all to whom these letters patent shall come:

Whereas Samuel Thomes Thomas, of Laconia, New Hampshire, has alleged that he has invented a new and useful improvement in fancy looms, which, he states, has not been known or used before his application; has made oath that he is a citizen of the United States, that he does verily believeth at he is the original and first inventor or discover of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the treasury of the United States the sum of thirty-five dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said Samuel Thomes Thomas, his heirs, administrators, or assigns, for the term of seventeen years from the eleventh day of February, one thousand eight hundred and sixty-two, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Samuel Thomes Thomas in the schedule hereunto annexed, and is made a part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand at the city of Washington this eleventh
125 day of February, in the year of our Lord one thousand eight hundred and sixty-two, and of the independence of the United States of America the eighty-sixth.

CALEB B. SMITH,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.
[SEAL.]

D. P. HOLLOWAY,
Commissioner of Patents.

The schedule referred to in these letters patent and making part of the same.

To all whom it may concern:

Be it known that I, Samuel Thomes Thomas, of Laconia, in the county of Belknap, and State of New Hampshire, have invented an "improvement in fancy looms," and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings and to the letters and figures marked thereon:

Fig. I, Sheet A, is a plan of the loom.
Fig. II, " is a front elevation.
Fig. III, " is a side elevation.
Fig. IV, " is a side elevation.
Fig. VII, " is a plan of the shuttle-driver.
Fig. V, Sheet B, plan of scroll cam and harness motions.
Fig. VI, " is an elevation of the same.

I will first describe the harness motions, which are produced by the scroll cam I, as shown on Sheet B, Figures V and VI. The crank-shaft J, turning on suitable bearings attached to the frame of the loom, carries at one end a scroll cam I, this cam, as well as other parts of the mechanism, being represented in the position they occupy when the the harness D E D[1] is at the centre of its traverse. The scroll cam is adjustable upon the crank-shaft J, by which means the time of the action of the harnesses is made to correspond with the motion of the lay. The spiral groove K in this cam receives the friction-wheel P that
126 is attached to the upper end of the right-angled lever L; as the cam revolves, the friction-wheel follows the groove, and elevates or depresses the other end of the lever L. To this end of the bent lever vertical rods are attached, which rise and fall at any required time, and raise or depress the harnesses.

The distance traversed by the end of the bent lever L is governed by the respective lengths of its long and short arms, and also by the shape of the groove K in the scroll cam.

A similar bent lever R and its friction roller Q are moved by the groove O in the same cam, and the vertical movement of the end of the two levers L and R is used for operating the harnesses in any desired manner, either in looms of my construction or in any other kind of looms.

My improvement in the shipper and brake for starting and stopping the loom is represented on Sheet A, Figures I, III, and IV. The protector-rod is seen at 25, and projecting from one end of it, at right angles, is the dagger 24. If the shuttle fails to reach the box, this dagger comes in contact with one end of the bent lever 22, and moves it a short distance; the other end of the bent lever is jointed to the bar 20, the motion of which brings an inclined plane 21 (near one end of the bar) in contact with one side of the slot 122, made in the loom-frame, through which the bar passes, thus moving the shipper spring 19 out of the notch 26; this allows the shipper 18 and its attached brake 33 to move horizontally against the flange 31, and it is there held by the tension of the shipper spring 19. This same motion of the shipper 18, acting through the clutch and collar 27, 28, removes the driving pulley 29 from contact with the driving cone 30; the friction is thus applied to the flange 31 at the same instant that the driving cone is released. The lay is thus arrested and its momentum nearly overcome, before the dagger 24 forces the bent lever 22 against the fixed stop 34, thus avoiding the sudden concussion that takes place by the stoppage of a loom by means of the apparatus heretofore in use. When the stoppage of the loom is caused by the breaking of the filling, the brake 33 instantly stops the

loom, so that the main crank makes but about half a revolution, while the shippers commonly used allow the crank to continue in motion, and the shuttle makes several shots before the loom is stopped.

127 I will now explain the action of the star-cams, the slide-wedges, draw-wires, and attached parts that communicate vertical motion to the shuttle boxes for the purpose of changing the colors of the filling or weft. The cam 100, attached to cam shaft 110, acts upon the rocker lever 116, which moves the horizontal pawl 117 (when the wire 111 leading to the shuttle box Jacquard is in the proper position) and turns the ratchet 1 and its attached cam 3 at proper intervals. The series of vertical bent levers 157, 157^{1}, which are acted upon by their respective star-cams, ratchets, and pawls of the series are suspended from the fixed pin 159, and have on one of their sides a projection or short arm 158; at the lower ends of 157 and 157^{1} the wires 160 and 161 are attached, and extend nearly parallel with each other to the wedges 165 and 166, the lower wedge 166 traversing at its lower edge upon a fixed slide or guide 181, while its upper edge runs in contact with an inclined plane formed upon the lower side, and near the end of a rocker lever 164. The other wedge 165 traverses on a slide at the top of lever 164, and its upper edge runs against the lower side of rocker lever 163. The free end of this lever 163 extends beyond the wedge, and is jointed to the shuttle box lifting rod 148. The two suspended levers 157^{II} and 157^{III} connect with the bent levers 169, 170, which pull the wires 200, 201, extending across the loom, which connect respectively with bent levers 171, which give motion to slides and wedges (corresponding to the slides and wedges 165, 166), and move the shuttle boxes upon the opposite side of the loom at proper intervals.

The apparatus for rolling up the cloth, called the "take-up," is shown on Sheet A, Figure IV, this operation being controlled by the horizontal motion of the reed. The flighter bar 312 is supported in the frame of the lay, its front edge resting against the lower band of the reed 420, against which it is held by the long springs 436^{II}, 436^{II}, having screws at 437 to regulate the pressure of the flighter bar upon the reed. On one side of the loom at the edge of the lug 205, a bent lever 315 is attached, its upper part resting against the flighter 312, and its lower part of such length as to meet the pins 434, 435, that project from the side of the horizontal sliding bar 313. This bar traverses in the guides 436, 436^{1}, and carries near its front end the pawl 314, which moves the

128 ratchet wheel 431 and the pinion 432 (which is fast to the same shaft as the ratchet), and drives the gear 433 that is attached to the cloth beam 419. A catch pawl 430 is fastened to the frame of the loom, and plays in the ratchet wheel 431. When the reed strikes the cloth with sufficient force to drive the flighter back a short distance, the bent lever 315 strikes the pin 434 and moves the slide 313 forward; this carries the pawl 314 forward, and drops it into the next tooth of the ratchet; at the back stroke of the lay the lever 315 strikes the pin 435 and turns the ratchet wheel, giving motion by means of the gears and pinion before described to the cloth beam 419, which winds up the cloth and draws more warp forward, the strain of the cloth upon the beam being sustained by the pawl 430. This mode of operating the "let-off" and "take-up" motions not only keep the warp at a uniform tension, but it also prevents the loom from making thin places in the fabric; because if the reed does not strike the cloth with sufficient force to drive the flighter back to a given point, the "take-up" ceases to draw the warp forward, and by regulating the weight 310 on the lever 309 any amount of tension may be given to the web that is desirable,

and the let-off motion will not deliver the warp until it receives the amount of tension required.

I am aware that looms have been stopped by causing the lay to release a shifting lever, which was made to operate a brake also; but what I claim is—

First. The mode of partially overcoming the momentum of the lay by means of the inclined plane, bent lever 22, brake, and flange, or their equivalents, previous to the final arrest of the dagger by a fixed stop.

Second. I claim the mode of elevating the shuttle-box levers by means of the slide wedges traversing in single or double guides, and operated by the draw wires and series of connected levers combined with the series of star cams and ratchets, acting on one or both sides of the loom, as set forth.

Third. I claim the combined action of two or more wedges or inclined planes, one above the other, for elevating the shuttle box, by means of which the extreme distance traversed by the box is about equal to the sum of the height of the large ends of the wedges.

Fourth. I claim the arresting or governing of the feed or take-
129 up motion that operates the cloth beam, by means of the action of the reed and flighter; the cloth beam and flighter being connected by the lever 315, slide 313, pawl 314, and ratchets 431, or their equivalents, as herein described.

SAMUEL T. THOMAS.

Witnesses:
EDWARD BLAKE.
J. M. BATCHELDER.

130 *Exhibit No. 4.—R. E. S., examiner.*

No. 8810.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify, that the annexed is a true copy from the records of this office of the specification and drawing with the letters patent granted Thomas and Everett, March 16th, 1852.

In testimony whereof, I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this twenty-fifth day of July, in the year of our Lord one thousand eight hundred and sixty-six, and of the independence of the United States the ninety-first.

[SEAL.] T. C. THEAKER.

Samuel T. Thomas, of Lowell, and Edward Everett, of Lawrence, Massachusetts, letters patent No. 8810, dated March 16, 1852.

To all to whom these presents shall come:

Be it known that we, Samuel T. Thomas, of Lowell, in the county of Middlesex, and State of Massachusetts, and Edward Everett, of Lawrence, in the county of Essex, and State aforesaid, have invented a new and useful improvement in "pattern cards for Jacquard looms," and we do hereby declare that the following is a full, clear, and exact de-
scription of the construction and use of the same, reference being
131 had to the annexed drawing, making a part of this specification, in which—

Figure 1 is a top view of two cards.

Figure II, end view of same.
Figure III, top view of the button.
Figure IV, top view of the needle holes and rivet holes.
Figure V, key to turn the buttons.
Figure VI, view of the side of the card which comes in contact with the pattern prism.

The object of our invention is to facilitate the operation of changing the figure or pattern of cloth that is woven upon a Jacquard loom, and to reduce the expense now incurred in changing and perforating the common pasteboard cards.

In Figure I, C D E F represents one of the cards which is made of tin plate, or other sheet metal, its length and breadth being such as to adapt it to the prism upon which it is to be used.

A hole is made at each end of the card, as at G H, to receive the tapered guide pin of the prism, which holds the card in the required position.

The card is perforated with round holes L L^1, their number and position being arranged with reference to the needles with which the card is to be used.

As the cards are usually made, one set can produce but one figure, every new figure requiring a new set of cards. By our improvement we are able to produce a great variety of figures with one set of cards, which we effect by attaching a button made of tin plate and of the form shown in Figure III to each hole as at A B, A^1 B^1, Figure 1. The button is of an oval form and has at one end a square aperture; in this a rivet is placed which passes through the small circular holes J J^1, Figure IV, in the metallic card, and is riveted upon the side opposite the button as in Figure VI. The rivet is prevented from turning in the button, by the square hole, its motion being confined to the round hole J in the card. The buttons are turned by a key of the form shown in Figure V, one end of the key being countersunk, so as to conform to the shape of the button. A certain part of the holes are closed by the buttons, as at A A^1, Figure 1, or open, as at B B^1, according to the figure required upon the cloth.

132 The cards are connected together by two or more metallic rings M M^1, thus forming the pattern chain.

What we claim and desire to secure by letters patent is the combination of the buttons with the metallic card as described, the buttons being so riveted or attached to the card as to allow of their being turned for the purpose of closing or opening the holes to which they are respectively attached.

SAMUEL T. THOMAS. [SEAL.]
EDWARD EVERETT. [SEAL.]

Witnessess:
A. W. HARMON,
JAMES D. RENICK.

Deposition of F. C. Treadwell, jr., taken, subscribed, and sworn to before N. Austin Parks, examiner; completed Sept. 17th, 1866.

SEPT. 11, 1866.

Int. 1. State your name, age, residence, and occupation.

Ans. Francis C. Treadwell, jr.; aged 43 years; residence, New York City; occupation, solicitor of patents; a large part of my time, however, is occupied in investigating the mechanics of patent causes, and testifying therein as mechanical expert.

Int. 2. State whether or not you have been accustomed to examine machinery and mechanism with reference to the questions of novelty, similarities, and differences. If yea, state generally how long and to what extent, and whether or not you have testified as an expert upon mechanical questions in the U. S. courts, and, if so, whether frequently or otherwise.

Ans. I have been accustomed to examine machinery with respect to substantial similarities and differences in construction and mode of operation for many years. For the past ten years I have been con-
133 stantly engaged in such examinations while pursuing my occupation as solicitor of patents, and in the examination of the state of the art preceding the time of the invention in controversy in patent causes, in which I have acted as mechanical expert. I have been examined as expert very frequently in most of the circuits of the eastern, middle, and some of the northern and southern circuits of the U. S. court. For several years past the greater part of my time has been devoted to the examination of machinery involved in patent cases, in which I have been employed as mechanical expert.

Int. 3. Please state whether or not you have had any, and what, acquaintance with the construction and operation of looms.

Ans. I have considerable acquaintance with the construction and operation of looms for weaving different kinds of fabrics, although I have never been engaged personally in the construction of looms. I have had occasion, in the course of my business, to examine a great variety of looms for weaving plain, fancy, and figured fabrics, and also to examine nearly all the patented descriptions of looms contained in the published English patents, and in the American patents. I also have examined a very large quantity of loom models, both in and out of the Patent Office. I have had occasion to testify, as expert, in contested cases in the Patent Office and the U. S. courts, involving some of the most intricate looms known in the art.

Int. 4. Please state whether or not you have examined a certified copy of the letters patent of the United States, being reissue No. 947, the original granted to Moses Marshall, dated 11th December, 1849, for alleged improvement in looms for weaving figured fabrics, said reissue being dated April 24, 1860, and granted to George Crompton, as assignee of Moses Marshall, and the specification and drawings thereto annexed; and whether or not you are acquainted with the mechanism therein set forth and the construction and operation of the same.

Ans. I have examined said reissue of said Marshall patent referred to in the question, and the specification and drawings thereto annexed, and believe that I understand the construction and operation of the loom therein described and shown.

Int. 5. State whether or not you have seen a loom of full size for practical use with mechanism for forming and shifting the shed con-
134 structed as described and represented in said reissued patent; and whether or not you saw the same operated.

Ans. I have recently seen such a loom, and witnessed attempts to operate it, and assisted myself in said attempts.

Int. 6. Have you or not seen looms constructed like the model marked "Exhibit B," so far as the mechanism is shown in said model, and have you or not seen them in operation?

Ans. I have seen a number of such looms in operation, and have also examined them when not in operation.

Int. 7. Will you please describe the combination of mechanism for forming and shifting the shed in the loom described and represented in said reissued patent, and also describe the operation of said mechanism.

Ans. The combination of mechanism described in said patent, which operates to form and shift the shed, consists of several mechanical devices. 1st. Of the ordinary leaves of heddles, which each act upon and control portions of the threads constituting the warp of the fabric. 2d. Of a double series of heddle levers, one series above and the other below the leaves of heddles, and connected therewith from their inner ends by suitable cords or straps, the lower series of heddle levers projecting outward farther from the side of the loom than the upper series. 3d. Of a series of peculiar instrumentalities, called jacks in this patent, which are provided with a double set of shoulders, or projections; one set, or pair, being used in connection with another device in elevating and depressing said jacks, and the other set of shoulders for the purpose of being used in connection with spring catches for the purpose of holding said jacks at certain times, when in their elevated and depressed positions. This series of jacks are each provided with the means of connection with, and are connected with, the upper and lower series of heddle levers, the connection being direct with the upper series; and by means of a cord, or wire, from the lower end of the jacks to the outer ends of the lower heddle levers, which outer ends of the lower heddle levers, projecting farther from the side of the loom than the outer ends of the upper heddle levers, cause the jacks to be suspended or hung in an oblique position by a sufficiently elastic means of suspension to permit them to be controlled while being moved up
135 and down, and, when at rest, by devices which interfere with their natural movement, and yet exert a constant force upon the jacks antagonistically to such devices. 4th. Of a peculiar mechanism for elevating and depressing the jacks, consisting of two bars mounted upon an endless pitch chain or carrier, and operated by a rotary motion, and in such relation to the jacks, that each of the bars becomes alternately a lifter and a depresser. 5th. Of a peculiar pattern mechanism. This pattern mechanism consists of an endless chain of cams, or cam rollers, mounted upon bars carried by the chain, and receiving a rotary motion from the mechanism which operates it. The pattern chain of cams is placed in such relation to the jacks, that by its rotation its cam rollers are brought to bear upon such of the jacks as are required to be moved by it into such positions as necessary in order to release them from the upper series of spring catches, so that they may be moved down. The cams of the pattern chain also are placed in such relation to the jacks as to hold the depressed jacks that are not required to be moved up on to the lower series of spring catches, while the other jacks are being moved to shift the shed. The cam rollers are of the width of the jacks, consequently, whenever there is a place upon the bars which carry the cam rollers not occupied by a cam roller, which place, in the revolution of the pattern chain, comes opposite to a jack, the pattern chain opposes no obstacle to the action of the oblique elastic suspending connection upon the jack, which (if a previous operation of the pattern chain, and other mechanism of the loom have placed it in a position to be affected by such action) will be drawn outward from the loom, and released from the spring catches which have held it, and placed in a position to be moved. 6th. Of a double series of spring catches placed in the loom, so as to catch upon the projections of the jacks for the purpose of holding them at certain times in their elevated and depressed positions. 7th. Of an evener, which consists of a pair of bars or rollers, mounted upon a frame, and moved back and forth at certain times, and with such relation to the outer ends of the upper series of heddle levers as to hold the jacks through the said series of levers in their extreme elevated and depressed

position, and also to control the movement of the jacks under the strain of the tension of the warp threads. The double series of spring
136 catches and the evener constitute the holding mechanism of the loom, the spring catches holding the jacks against the strain of the tension of the warp threads a part of the time, and the evener also holding them a part of the time. This combination of mechanism operates to form and shift the shed by and through the jacks, as follows: The shed being open, and the shuttle with the filling thread having been thrown, such jacks as are necessary to be moved in order to shift the shed are released from the catches by the direct action of the roller cams of the pattern chain, or permitted to be released by the absence of a cam roller of the pattern chain, the pattern chain rotating a distance of one link in order to effect this change. The jacks thus released from the catches are drawn upward or downward, as the case may be, by the strain of the tension of the warp thread upon the heddles connected with them. The heddles and jacks being counterbalanced, or in equilibrium, as directed in the patent, the strain of the warp threads acts like a bow-string to draw the jacks instantly to their mean position, and at much greater speed than the elevator and depresser bars can follow them; and in order to prevent this action, the evener is made to move along the bevelled edges of the outer ends of the upper series of heddle levers, so as to gradually control and direct the ascent or descent of the jacks, and consequently to prevent the ascent or descent of the warps into the shed in advance of the movement of the elevator and depresser, this part of the operation of the evener being to keep the jacks back, so as to move practically with the elevator and depresser for the purpose of keeping that portion of the shed to be moved from going so fast as to close upon the shuttle before it could get through the shed. As the jacks are being moved downward, they are held by the cam roller of the pattern mechanism inward, towards the side of the loom, in opposition to the antagonistic action of the elastic oblique connection. When they approach the termination of their upward and downward movement, they force back the spring catches by cams on the backs of their shoulders, which shoulders, after the catches have been forced back, rest upon the catches which immediately spring in under the shoulders at the termination of the movement of the jacks. Those jacks which have been moved downward, while held inward toward the loom by the cam roller of the pattern chain, are held inward and under the spring catches by the
137 same cam roller, and succeeding cam rollers of the pattern chain, until the absence of a cam roller permits the jack to be swung out from under the catch by the elastic oblique connection; and the pattern chain of cams is so constructed and placed with relation to the jacks that in its revolution a series of cam rollers are successively brought against any jack desired to be held down during a series of changes of other jacks, without practically releasing the jack to be so held down from the action of the cam rollers of the pattern chain which hold the jack inwards towards the loom under the catches; or, in other words, the pattern chain is shifted to change the pattern without moving it away from the jacks sufficiently to release, or permit a release movement of, a jack from the spring catches. The cams of the pattern chain also hold the jacks inwards, when moving down, within the range of the depressers. When the jacks have arrived at their extreme range of motion, the evener moves in between the ends of the levers of the upper series of heddle levers that have been raised, and the ends of the levers of the same series which have been depressed, and holds the jacks through these heddle levers in their extreme elevated or depressed position against

the strain of the tension of the warp threads. And this is necessary, because the lifter and depresser then leave the jacks, and in case the catches should, by reason of the jar of the loom, or the general uncertainty of the mechanism, fail, the jacks, and consequently the shed, will be held open at that time to permit the passage of the shuttle, and from the time that the lifters and depressers leave the jacks, to the time when they again take hold of them in opposition to the strain of the warp thread, the evener controls, as I have before stated, the motion of the jacks so as to prevent them from being moved in advance of the movement of the elevator and depresser by the strain of the tension of the warps, and the warps consequently from going into the shed to obstruct the movement of the shuttle, as I have before stated. The jacks that are not to be moved are acted upon by the evener through the heddle levers only at the time when the shed is open, and the action of the evener with respect to them is supplemental, operating in case of accident; these jacks being at that time either held inwards toward the loom under the lower series of spring catches by the cam rollers of the pattern chain, or outwards away from the loom over the upper
138 range of spring catches by the elastic oblique connection between them and the outer projecting ends of the lower series of heddle levers. I should have stated as one of the peculiarities of the jacks, in the first part of my answer, the inclined cam surfaces behind the shoulders of the jacks, which take upon the spring catches these inclined cams, operating in conjunction with inclined or bevelled surfaces upon the spring catches to throw back the catches, so as to permit the shoulders which are to rest upon the catches to pass them.

Examination adjourned to Sept. 12, 1866, 10 a. m.

Examination resumed Sept. 12, 1866.

Int. 8. Please state whether or not you have examined the complainant's model, marked B, and whether or not you understand the mechanism of the loom represented by said Model B, and its construction and operation.

Ans. I have examined such model, and I do understand the mechanism of the loom represented by it, and its construction and operation.

Int. 9. Please state whether or not the combination of mechanism for forming and shifting the shed in the loom, represented by said Model B, is the same or substantially the same as the combination for that purpose described by you as existing in the loom described and represented in said reissued patent, or is substantially different therefrom; and please give your reasons for your opinion on that subject.

Ans. I consider that the combination of the mechanism for forming and shifting the shed in the loom represented by complainant's Model B, is substantially different from the combination for that purpose described by me in my last answer, as existing in the loom described and represented in the said Marshall reissue. The mechanism of the loom represented by the model B is, in my opinion, not only substantially different in construction, but embodies a substantially different mode of operation in forming and shifting the shed from that of the mechanism of the said Marshall reissue. In the loom represented by the model B, there is but a single series of heddle levers, and they are all of the same
139 length, and are placed at the side of the loom; whereas in the mechanism of the Marshall reissue, there is a double series of heddle levers, namely, an upper and lower series, one above and the other below the loom, the levers of the lower series being longer than the upper series, and their outer ends projecting further from the side of the loom than the outer ends of the upper series. This I consider a substantial differ-

ence, because it involves a substantial difference in the mode of operation of the jacks in the two looms, the jacks in the mechanism of the Marshall reissue deriving one of their most important motions requisite in that mechanism for the forming and shifting of sheds from their being suspended obliquely from and between the upper and lower series of heddle levers. This oblique elastic suspension of the jacks is the direct consequence of the difference in the length and degree of projection from the side of the loom of the upper and lower series of heddle levers. If both series were of the same length and of the same projection from the side of the loom, the jacks would not be drawn over the upper series of spring catches, or held by them when at the upper extremity of their movement it is desired to hold them by the catches, in order to hold that portion of the shed open which they control; neither would the jacks be released when in the operation of the Marshall mechanism it becomes necessary to release them from the lower series of spring catches, in order that they may be moved upwards to shift the portion of the shed that they control. Now, the heddle levers of the loom represented by the exhibit B, being all of one length and all in one series, no such mode of operation upon the jacks of that loom is possible. The jacks are not suspended between them; but on the contrary, they are separated from the heddle levers by cam sectors, which connect with the jacks by rack teeth and a rack on the lower end of the jacks, the upper end of the jacks not being in any way suspended or connected with the heddle levers, and having no motion to hold or release them, or for any other purpose whatever derived in any manner from the heddle levers

In the loom represented by Model B, the jacks are substantially different in construction and mode of operation, and also in their combination with and relation to the other parts of the mechanism for
140 forming and shifting the shed, from the jacks described in the Marshall reissue.

In the first place, they are not constructed so as to be suspended between an upper and lower series of heddle levers, as in the Marshall reissue, there being no holes in their ends or other mechanical means of making such connection. Secondly, they have but one pair of shoulders (such as are common to all jacks operated by lifters and depressers, and these shoulders co-operate only with the lifters and depressers for moving the jacks to shift the shed. The shoulders which co-operate with the spring catches in the jacks of the Marshall reissue are not upon the jacks of loom represented in Exhibit B, neither is there upon any of said jacks any equivalent for shoulders to hold the jacks in their elevated and depressed positions by spring catches or any equivalent therefor. Third, the jacks in loom Exhibit B, not having any shoulders or spring catches to obstruct their upward or downward movement, are not required to be moved laterally in order to release them from such catches, as is the case in the jacks of the Marshall loom, but are moved at once vertically. In the loom represented in model Exhibit B, the jacks have a lateral movement for the purpose of engaging them with the lifters and depressers; but this lateral movement differs from the lateral movement in the jacks of the Marshall reissue, the jacks in the Marshall reissue moving inwards to engage the depresser when released from the upper series of spring catches and moving outwards to engage the elevator when released from the lower series of spring catches; and this because they are held in such positions by the pattern mechanism and the oblique elastic connections from the time they are lifted or depressed to the time when they are required to be moved; whereas, in the operations of the jacks in the loom represented by Exhibit B, they are always

moved outward from the loom when moved to engage the depresser, and are not moved from their normal position when down to engage the elevator. The reason of this is that in the loom represented by Model B, the pattern mechanism retreats from the front-weighted levers at every revolution of the crank-shaft, or between the formation of one shed and the next, thus leaving the front-weighted levers free to act upon all the jacks, to throw them all back into line, and they are then moved from the line outwards, when required to be depressed, by the back-weighted levers, which are enabled thus to move them by reason of their corresponding front-weighted levers being lifted by the vertical upward movement of the pattern prism. This difference I consider substantial as a difference in mode of operation; because, if the jacks were all brought in line in the Marshall mechanism, as in the mechanism of loom represented by Model B, those which had been depressed would be release or drawn out from their spring catches, and could not be held by them. Now, I am aware that there are in the cam-slots of the cam-sectors in Model B, concentric portions, but these concentric portions oppose no resistance whatever to the upward or downward movement of the jacks, and therefore, in my opinion, besides being substantially different mechanical instrumentalities from spring catches, have not substantially the same operation or effect in the combination of mechanism that the spring catches of the Marshall reissue have. If they have any useful effect in the operation of the loom represented by Model B, it is to assist in holding the heddles. But here again the mode of operation of the two mechanisms differs substantially, because in the loom described in the Marshall reissue the jacks must first be released from the holding mechanism by the operation of the pattern mechanism before they can be moved up and down; whereas, in the loom represented by Model B, the jacks are not released from any holding mechanism, but must at once be moved up and down to release the heddles from the concentric portions of the cam slots. I am also aware that in loom represented by Model B, there is a series of friction brakes which constantly bear with pressure upon the peripheries of the cam sectors, and that the result of the action of those brakes is to oppose a frictional resistance to the movement of all parts of the loom with which the cam sectors are directly connected, and thus, incidentally, to prevent the jacks, or any of them, from being moved from any position they may be in in the operation of the mechanism of the loom, except by a force sufficient to overcome the friction of the brakes; but I do not consider these brakes either a substantially equivalent device or as having an equivalent mode of operation, or as having any mechanical resemblance to the device of the spring catches and their shoulders on the jacks in the loom of the Marshall reissue. In the first place, the brakes are not applied to the jacks, and could not be without preventing their oscillation, which is necessary to relieve them from and engage them with the lifters and depressers; and, if they were, they would not, in my opinion, be substantially the same or equivalent means of holding the jacks in any position. The difference between the use and operation of the brakes and the spring catches, could the breaks be applied to the jacks, is the same as the difference would be between using a window-catch and making the sash fit the window-frame so tight that it could not be moved up and down without the application of more force than the friction required to hold it in position.

141

142

In loom represented by Model B, there is no evener, and no equivalent for the evener of the loom described in the Marshall reissue, the parts of the loom in Model B, in whatever position they may be, being pre-

vented from being moved (either by the tension of the warps, or by preponderance of weight of harness and connections) by the brakes, which operate simply by friction, and permit the parts to move under this friction whenever a superior force is applied to them. The brakes are stationary, have no mechanical relations, such as movement at proper time and place, or in conjunction with surfaces adapted to oppose the mechanical resistance of pieces of metal brought in opposition, as in the operation of the evener, more particularly described by me in my preceding answer. Moreover, the brakes are not, and do not require to be, released from their contact, or their action intermitted, in order to permit the jacks and harness to be moved up and down, as is the case with the operation of the evener of the loom described in the Marshall reissue. Another substantial difference between the mechanism of the combination for forming and shifting the shed in the loom represented by complainant's Model B, and the combination of mechanism for that purpose in the loom described in the Marshall reissue, exists both in the constuction and mode of operation of the pattern chains of the two looms, and their relation to and effect upon the devices with which they are respectively combined and operate. In the first place, the pattern chain of the loom represented by Model B consists of an endless chain of perforated cards or plates, instead of an endless chain of cam rollers, as in the Marshall reissue, the perforated plates of the one having no action like, or substantially like, the cams of the other, and, from their very nature, require to be moved some distance away from the intermediate mechanism
143 through which they act to select the jacks in order to change the figure; whereas, in the operation of the pattern chain of cams, it is moved to change the figure while the cams are directly in contact with the jacks. In the operation of the pattern chain of Model B, or any pattern chain of like, or substantially the same, construction, an intermediate mechanism, independent of the pattern chain, must always be placed between the jacks and the pattern chain, in order to have the pattern chain operate to select the jacks; and this intermediate mechanism must be such as to be operated, and permitted to operate, by the pattern chain, to move the jacks laterally, that are required to be so moved to change the shed and yet permit of the free movement of the jacks up and down, when moved in changing the shed. It must also have the capacity of keeping the jacks in some uniform defined position laterally, from which they are moved, or permitted to move, by the operation of the pattern chain upon the intermediate mechanism. Such an indermediate mechanism I find in the weighted front and back levers which act to move the jacks laterally in the loom represented by Model B. There is no such mechanism, and no necessity for such, between the pattern chain and jacks in the loom described in the Marshall reissue. In the use of the pattern chain of the loom represented by Model B, pins projecting from the intermediate mechanism are essential to co-operate with the perforated plates in selecting the jacks, and the relation of these pins to the perforated plates and intermediate mechanism is such, and must of necessity be such, that a rectilinear movement of the perforated plate of the pattern chain, in line with the line of the pins, is absolutely necessary to the operation of selecting the jacks, and having them moved laterally to engage with the lifter and depresser. There is no such movement of the pattern chain of cams in loom described in the Marshall reissue; and if there were, one of the functions performed by said pattern chain of cams, that of holding the jacks under the lower series of spring catches would not be performed in that loom, neither would another of the functions performed by said pattern chain of cam rollers in said loom be performed,

that is, of holding the jacks inward toward the loom, and within range of the depressers while they are being moved downward; because
144 such rectilinear motion would involve the release of the jacks in said Marshall loom from the action of the cam rollers, in opposition to the action of the oblique elastic connection, by reason of the pattern chain of cams moving away from the jacks, and ceasing, for the time, to have further control of them. In the operation of the loom represented by Complainant Model B, the lateral movement of the jacks to engage with the lifter and depresser, is effected by the weighted levers before and behind the jacks, the front levers being sufficiently heavy to move the jacks inward towards the loom, against the action of the back-weighted levers, which latter are sufficiently heavy to move the jacks outward from the loom whenever they are relieved from the weight of the front levers by the rectilinear movement of the perforated pattern chain, and, when engaged with the lifters and depressers, the perforated plate moves away from the front-weighted levers, and has no influence or control whatever upon the jacks, either directly or indirectly, during their upward or downward motions, or, when up or down, to hold them, or assist in holding them. In the operation of the loom of the Marshall reissue, the jacks are moved directly when required to be depressed, by the rotation of the cam rollers of the pattern chain. If spring catches should be put upon the loom represented by Model B, and shoulders also be put upon the jacks for the catches, and no other change made in the mechanism of the loom, except to relieve it of the brakes, the spring catches could not act to hold the jacks in their elevated or depressed positions, because of the fact that the jacks are, at every revolution of the loom, brought in line with each other by the action of the back and front levers, which would throw the jacks off from the catches; and if the back and front levers were taken out of the loom represented by Model B, there would be no means of oscillating the jacks in order to engage the lifter and depresser. There being, in the loom represented by Model B, no shoulders on the jacks, or spring catches on the loom for the purpose of holding them up or down, there is no necessity for the exercise of the capacity which the pattern chain of cams contains and exercises in the loom of the Marshall reissue in releasing the jacks from, and in holding them up to the spring catches, and no such capacity exists in the pattern chain of the loom represented by Model B. I have stated in this answer that the jacks of loom represented by Complainant Model
145 B are oscillated to engage with the lifter and depresser by the front and back weighted levers; but I do not consider these front and back weighted levers as substantially the same mechanical devices, or as having substantially the same mode of operation for the purpose of oscillating the jacks as the mechanism of the loom described in the Marshall reissue for that purpose, viz., the cam rollers of the pattern chain, and the oblique elastic connection with the upper and lower series of heddle levers. In fact, their operation is totally different in oscillating the jacks, because the operation of the weighted levers is to bring the jacks in line at every revolution of the loom, when in their elevated and depressed positions, as I have before stated, whereas the operation of the cam rollers of the pattern chain and the oblique, elastic connection of the jacks with the heddle levers in the loom of the Marshall reissue, is to hold the jacks out of line with each other and in range of the opposite series of spring catches, the latter mode of operation enabling the catches to hold the jacks inwards or outwards from the loom, whereas the former would, as I have stated, release the jacks from one of the sets of catches, if catches were used.

Int. 10. Suppose that the evener be thrown out of the combination described by you as existing in the loom described and represented in said reissue, and that the combination so produced operates to move and hold the jacks in the manner set forth in said reissue, state whether or not you then find, in the loom represented by Model B, a combination which is the same, or substantially the same, as the said combination without the evener, in the loom described and represented in said reissue, and give your reasons for your opinion.

Ans. The loom represented by Model B does not, in my opinion, contain the same, or substantially the same, combination for shifting and forming the shed as described by me, in my preceding answers, as existing in the loom of the Marshall reissue, throwing out the evener, as assumed in the question. My reasons are the same as given in my last answer, leaving out that part of it which refers to the operation of the evener.

Int. 11. Suppose the combination in said reissue is the combination of the jacks that operate the series of leaves of heddles with the
146 lifter and depresser and pattern chain (or any equivalent apparatus for determining the pattern), and the mechanism for holding the jacks, either in their elevated or depressed position, when not required to be operated, all substantially as in said reissue set forth; will you then state whether or not you then find the same, or substantially the same, or a substantially different combination, in the loom represented by Model B, assuming, in the first place, in making your answer, that the spring latches, or catches, with the outer shoulders of the prongs of the jacks, and also the evener, constitute the holding mechanism; and then, in the second place, assuming, in making your answer, that the spring latches, or catches, with the outer shoulders of the prongs of the jacks, constitute without the evener, the holding mechanism; and will you please give your reasons for your conclusions?

Ans. In my opinion, the combination inquired of, either with or without the evener, as existing in the loom described in the said Marshall reissue, is not contained in the loom represented by complainant's Model B; neither is there in said loom substantially such a combination. My reasons are given at length in my answer to the 9th interrogatory, leaving out what I have there said about the evener, when considering the combination as without the evener, as a part of the holding mechanism. It is impossible for me to consider the combination of jacks, lifters, and depressers, pattern chain, and holding mechanism of the loom described in the Marshall reissue, without taking into consideration the oblique elastic connection of the jacks, and the upper and lower series of heddle levers of that loom, because it is the combining mechanism whereby the jacks have not only place in the combination, but are enabled to cooperate with, and to be acted on by the other members of the combination, viz., the pattern chain, the lifters and depressers, and the spring catches; and therefore I refer to the whole of my 9th answer for my reasons for the opinion I have expressed in this answer, when considering the combination inquired of as including the evener; and leaving out such portions as refer to the evener, when considering the combination inquired of as not including the evener. If, however, the question is not meant to include the connections of the jacks with the upper
147 and lower series of heddle levers, as a part of the combination of the Marshall loom inquired of, I will add, as a further reason why the combination of the loom in Model B is sustantially different, that there would be no operative combination in the said Marshall loom under such circumstances, or if the jacks of said Marshall loom were only

connected at one end, as in the loom represented by model Exhibit B, there being no spring catches, or any equivalent device whatever, to act upon the jacks, in loom represented by Model B, to hold them in any position. One of the members of the combination inquired of (viz., the spring catches and shoulders on the jacks), has no existence, and there would be nothing equivalent to hold the jacks; and the evener, not being present in the said loom represented by Model B, and not being a co-operative member of the combination inquired of in the loom described in the Marshall patent (unless the jacks are connected with the upper series of heddle levers in that loom), may as well be left out of consideration altogether. But whether such combination be operative or not, in my opinion there is not, in loom represented by Model B, the combination, or substantially the combination, of pattern mechanism, lifters and depressers, spring catches and jacks, with or without the evener inquired of, that is, in the loom described in said Marshall reissue, by reason of the substantial differences in construction and mode of operation of the pattern chain, jacks, spring catches, and evener of the said Marshall loom, and the said loom represented by Model B, which I have fully set forth in my reasons given in the answer to 9th interrogatory.

Int. 12. Suppose the spring latches, or catches, with the shoulders on the jacks on which the latches or catches act, set forth in said re-issue, do in fact hold the jacks in their elevated and depressed positions during the whole time that they are required to be held in their elevated and depressed positions. Will you state whether or not you then find the same, or substantially the same, combination in said Model B that you would, under such supposition, find in said reissue?

Ans. I do not.

Int. 13. State whether or not the loom represented by Model B contains the combination, or substantially the combination described
148 in said reissue patent, and referred to in the first claim of said reissue, and please give your reasons.

Ans. In my opinion, it does not; for the reasons I have already given, respecting the substantial differences between the combination of mechanism in loom represented by said Model B, and the combination of jacks, lifter and depresser, pattern mechanism, and the mechanism for holding the jacks, either in their elevated or depressed position in the loom described in said Marshall reissue, whether or not the evener be included as a part of said holding mechanism.

Adjourned to 13th, at 10 a. m.

SEPT. 13, 1866.

Resumed:

Counsel for respondents, in pursuance of a verbal notice given to complainant's counsel on the 11th inst., hereby notifies the complainant's counsel on the record, that the complainant's counsel and client and his experts can, in the presence of defendants' counsel and experts, see and operate at the Arlington Mills, in Lawrence, to-day, or at such other reasonable time as complainant's counsel may designate, the Marshall loom and the two Thomas looms referred to by Edward S. Renwick in his deposition, as having been operated in his presence, and that the complainant may operate the same fully and freely by his own operator, or by Moses Marshall himself, or by Mr. Henry B. Renwick, complainant's expert, who is now present, or by any other expert of complainant, or any operator that he may select, without any interference or interruption by the defendants, or any of their experts or counsel, or any one else.

Int. 14. Do the concentric portions, or either of them, in the slots in the sectors, in loom represented by Model B, hold, or have any agency in holding, the jacks in that loom, either in their elevated or depressed positions? Please give your reasons for your opinion.

Ans. They do not. The curve of the concentric portions of the slot being concentric with the centre of motion of the sectors, the movement of the sectors is not opposed by the roller connected with the power arm of the heddle levers, which lies in the concentric portion
149 of the cam slot of the sectors, when the jacks are in their elevated and depressed positions. There can be, therefore, no obstruction to the movement of the jacks by the concentric portions of the cam slot and the friction roller above referred to, except the mere friction of the surfaces, which is mechanically immaterial; the friction roller or wheel, being the ordinary mechanical device used under such circumstances to prevent the friction.

Int. 15. Have the concentric portions of the sector cam slots, in loom represented by Model B, the same, or substantially the same, relation, combination, or mode of operation, in conjunction with the jacks, lifter and depresser, and pattern mechanism of said loom, for any purpose, as the combination of jacks, lifter and depresser, pattern mechanism, and holding mechanism in loom described in said reissue—assuming that the holding mechanism in said reissue is the spring latches, or catches, with the outer shoulders of the prongs of the jacks, or any equivalent mechanism? And state your reasons for your opinion.

Ans. They have not. My reasons will be found stated at length in that portion of my answer to the 9th interrogatory, which relates to the concentric portions of the cam slots, and their operation as compared with the operation of the spring catches in the combination inquired of. A characteristic difference in the two combinations is, that in the Marshall combination the shed is held open by and through the jacks, by means of the spring catches applied to the jacks when they are in their elevated and depressed positions, and not required to be moved for forming the shed; whereas in the combination of loom Model B, the shed is held open, so far as respects the action of the concentric portions of the cam slots, by an appliance which not only does not operate upon or through the jacks to hold the shed open, but operates directly upon the heddle levers, and opposes no material mechanical resistance to the up-and-down movement of the jacks; but, on the contrary, requires such movement of the jacks to be made while it is holding the shed open, in order to release the heddle levers from its action.

Int. 16. Please answer the preceding question—supposing that the evener with the spring latches, or catches, with the outer shoulders of the jacks, or any equivalent mechanism, constitute the holding
150 mechanism in the loom described in said reissue; and please give your reasons.

Ans. My answer will be the same as the last answer; for the reason that the evener is a substantially different device, and operates in the loom for a different purpose from the purpose of the concentric portions of the cam slots. In the first place, the evener is a reciprocating instrument, which lies across the whole series of heddle levers, when holding them in their elevated and depressed positions, and must hold all, or none; whereas the concentric portions of the cam slots act independently of each other, to hold the heddle levers when in their elevated and depressed positions; there being twice as many concentric portions of the cam slots as there are heddle levers in the loom Model B, and only one evener to all the heddle levers in the Marshall loom.

The concentric portions of the cam slots hold the heddle levers during a succession of picks, when they are not to be moved to change the shed. The evener only holds the heddle levers during a portion of the revolution of the loom, whether they are to be moved or not during successive picks, and, of necessity, is moved away from all of the heddle levers at every revolution of the loom, in order that such of the heddle levers may be moved as is necessary to move to shift the shed. And this necessity arises from the fact of the evener being one instrument operating upon all the heddle levers in common, in the Marshall loom, instead of being a plurality of instruments, each of which have a separate, distinct, and specific operation upon their respective heddle levers, as are the concentric portions of the cam slots in Model B.

Adjourned to Saturday, 14th inst., 10 a. m.

Resumed.

Int. 17. State whether or not you have witnessed any experiments in the loom referred to by you in your answer to 5th interrogatory. If yea, please state fully what they were, and the results, and who were present, and when and where you witnessed such experiments.

Ans. I have witnessed experiments with the loom referred to. The loom was at the Arlington Mills; it was on the 29th of August last,
151 more particularly, that I saw experiments made in the presence of Robert Davis, Samuel T. Thomas, Leonard Pierce, Joshua D. Ball, Edward S. Renwick, and others whose names I do not know. We tried the loom at different speeds to see how it would work, and found that it would only run at very slow speed, and that the operator must keep his hand upon the stopping and starting lever in order to at once disconnect the power from the loom to prevent breakage when the jacks improperly detached themselves from the catches, which they were liable to do, and did do frequently. The uncertainty of the operation of the loom, in my opinion, arose from the peculiar nature of the mechanical devices employed to form and shift the shed, and not from defect in mechanical construction. We tried the loom without the evener, and found that the strain of the tension of the warp threads drew the jacks that were to be moved up and down faster than the lifters and depressers could follow them, until those portions of the warps connected with the jacks came into the shed sufficiently to close upon the shuttle. The experiments upon this practical loom demonstrated what the drawings and description of the mechanism for forming and shifting the sheds in the Marshall reissue had previously indicated to me, viz., that in such a loom the operation of the evener was indispensable, because the harness and jacks being counterbalanced, as directed in the patent, as soon as the jacks are released to shift the shed, the strain of the tension of the warp threads acts to draw them instantly to or towards their mean position so much in advance of the movement of the lifters and depressers, that were it not for the evener (which holds the jacks through the upper series of heddle levers, and by travelling outward in connection with the bevelled outward ends of said levers, controls the upward and downward movement of the jacks between the time of starting and the time they arrive at their mean positions, or nearly to their mean positions), the warp threads moving to shift the shed for the next throw of the shuttle would close upon the shuttle then passing through, and stop it in the shed, or if thrown with sufficient power to force its way through would spoil the figure. The running of the loom was necessarily accompanied with considerable jar, arising from the nature of the construction, which had a tendency to defeat any precise calculations of the time of movement or release of the jacks. The experiments satisfied

152 me that the evener, or some equivalent device, is essential in such a loom as a part of the mechanism for holding and shifting the sheds through the jacks, and that the loom would not be practicable without it, although with it it will work imperfectly.

Int. 18. State whether or not in the loom described in said reissued patent the evener has or has not any agency, and, if so, what, in holding the jacks in their elevated and depressed positions.

Ans. It does hold them in their elevated and depressed positions while the pattern mechanism is moving to change the figure, select the jacks, and to release, or permit them to be released, from the spring catches; and when released from the spring catches, it holds them, as I have previously stated, so as to prevent their moving in advance of the movement of the lifters and depressers, which they would do were it not for the evener.

Int. 19. How essential is the evener, in your opinion, in the combination for forming and shifting the shed in said reissued patent?

Ans. So essential that the operation of holding, forming, and shifting the shed in that loom could not be carried on without it, or its equivalent, in the practical operation of the loom in weaving.

Int. 20. How many looms in all have you ever seen constructed as set forth in said reissued patent, in respect to the combination for forming and shifting the shed, and where did you see the same?

Ans. None but the one I have referred to at the Arlington Mills.

Int. 21. Please state whether or not you have witnessed the practical operation of any looms constructed in conformity with Model B, so far as concerns the mechanism thereby represented. If yea, when and where; and state whether or not the concentric portions of the cam slots were removed from any of the sectors; and state the operations which you thus witnessed, and their results, and who was present.

Ans. I have frequently seen looms in operation which contained the combination of mechanism represented by Model B substantially as they are represented, and I have also seen such looms in all respects the same, except that the cam slots in the cam sectors had their concentric portions removed. I saw two looms of the latter kind in operation at the Arlington Mills, one of them a narrow loom, and the other
153 a broad loom. It was on the 29th of August last, and Edward S. Renwick, Joshua D. Ball, Robert Davis, Samuel T. Thomas, Leonard Pierce, and others were present. I again saw the narrow loom yesterday, both at rest and at work. A part of the time Causten Browne, Henry B. Renwick, George Crompton, and a gentleman whom I am informed is Moses Marshall, Edward S. Renwick, Samuel T. Thomas, and Joshua D. Ball were present. I am not certain that Messrs. Browne, H. B. Renwick, Crompton, and Marshall examined the loom while it was working. I believe they did not. My impression is, they were then examining the Marshall loom, which stood close to it, and that when they examined the narrow Thomas loom it was at rest. On the 29th of August I saw the narrow Thomas loom worked with four leaves of heddles, the cam sectors corresponding with them having brakes upon them, and the combination the same as in Model B, with the exception that the cam slots contained no concentric portion. It worked just as well as any of the looms with concentric portions in the cam slots. We tried it weaving with the warp at various different degrees of tension, and with the filling drove up with various degrees of closeness, subjecting it to as severe a test, in my opinion, as any fancy loom is capable of. I had the brakes taken off, and also wove without them, under sufficient tension and strain for ordinary fancy weaving for about five minutes

without missing a pick; but the loom did not operate so smoothly without the brakes as with them. On the broad loom, on the said 29th of August, there were eight cam sectors in operation without any concentric portions in their slots, they having been removed therefrom by cutting out portions of the sectors and dovetailing in small pieces of iron to fill up the concentric portions. The broad loom in this condition, in all other respects substantially the same as Model B, worked just as well as the other looms in the mill which had sectors with the concentric portions in their cam slots, and on a much heavier fabric than the other looms were weaving. At the close of the operations of the broad loom on said 29th of August, two of the working cam sectors which were used in its operation were taken out of the loom in my presence, one of which Mr. E. S. Renwick took charge of, and the other was given to Robert Davis. The result of the operation of both the broad
154 and narrow loom without the concentrics was, in my opinion, equal in every respect to the operation of the looms with the concentrics, and demonstrated to my satisfaction that the concentric portions of the cam slots in the cam sectors of the other looms were of no practical use in their operation.

Int. 22. Please state whether or not you have, since said 29th day of August, seen the cam sector containing no concentric portions which you, in your last answer, say Mr. Edward S. Renwick took charge of. If yea, when and where?

Ans. I have. It was produced by Mr. Edward S. Renwick in my presence, doing his examination in this case at New York.

Int. 23. Please state how, with reference to holding the jacks in their elevated and depressed positions, said two looms operated, which you, in your previous answer, have styled the "narrow" and "broad looms," when operated in your presence with the concentric portions in the cam slots removed.

Ans. The jacks in those looms were maintained in their elevated position by the teeth of the cam sectors, with which they are connected by a rack, as the cam sectors being under the operation of the friction of the brakes, of course, only moved when a superior force was applied to them by the elevators and depressers. When the jacks were in their depressed position, their own gravity was suffieient to prevent them from moving up; the sectors, with which they were connected, being under the friction of the brake, and there being nothing else to move them up, until the lifters took hold of them.

(Adjourned to 3 p. m.)

Int. 24. Please state whether or not the jacks where held in their extreme elevated and depressed positions as much in the two looms, which you saw operated with the concentric portions of the cam slots removed, as they were held in the looms having the concentric portions in the cam slots.

Ans. They were maintained in those positions when not required to be moved as well and in precisely the same manner as in the other looms.

Int. 25. Please state whether or not the slot in the cam sector
155 produced by Mr. Edward S. Renwick, as heretofore stated by you, has any concentric portions in it, or had at the time you saw it operated; and how it compares in that respect with the cam slots in the other sectors, which were operated in the narrow loom and broad loom, and which you have referred to as seen by you operated with the concentric portions of the cam slots left out.

Ans. It has not; nor had it at the time when I saw it operated, and is

the same in that respect as the rest of the cam slots of the sectors which were operated in the narrow and broad loom I have referred to. The cam slots in the broad loom that were used in the operation were all altered before the trial, in the same manner that the cam slots in the sector produced by Mr. Renwick were altered. The cam slots of the sectors of the narrow loom appeared to have been made originally without concentric portions in them, and did not require to be altered.

Int. 26. State whether or not the pattern chain in the loom represented by Model B has any advantages as compared with the pattern chain, or pattern mechanism, in the loom represented by Model A. If yea, what?

Ans. It has a very decided advantage over the pattern chain of Model A in respect to its cheapness of construction, being merely a chain of perforated tin plates, which are easily made, instead of a chain of cam rollers, which are much more difficult, and more expensive to make. It also has a great advantage over the pattern chain in Model A in changing the figure; because, by means of the buttons, it contains within itself the capacity to change the pattern of the figure to be wrought in the loom without being removed from its operating mechanism, and simply by closing or unclosing the holes by the buttons; whereas in the use of the pattern chain of Model A, in order to change the pattern of the figures to be wrought in the loom, the bars in which the can rollers of the chain are placed, must be taken apart from the chain, the cams that are to be removed or shifted to change the pattern of the figure taken off from those bars or shafts, and some of the thimbles, or washers, which keep the cams in place, also taken off of those bars, and rearranged by putting both the thimbles, or washers and cam rollers, in different relations to each other, and also, if more or less cams be required in the pattern, by either putting them on, or taking them
156 off of the bars with a sufficient number of washers between them; and as some figures may require more cams than others, and less washers, there must always be a depository somewhere of washers and cams for this pattern chain of cams, in order to enable the pattern chain to weave the variety of different patterns required on the fancy loom.

Int. 27. State whether or not, in your opinion, the loom described in said reissue patent is, or is not, practically valuable for weaving purposes, as compared with other looms previously in use.

Ans. So far as I know, from descriptions I have seen of looms, prior to the date of the Marshall original patent, I should say that there were looms, before that time, of much greater practical value for weaving, than the said Marshall loom, as described in the reissue patent.

Int. 28. State whether the brakes in the loom represented by Model B are, or are not, substantially the same, or have, or not, substantially the same operation as the evener in the loom represented by Model A, and give your reasons.

Ans. I consider them substantially different as mechanical devices, and having a substantially different mode of operation. They apply friction to the sectors, without interposing any mechanical obstruction to their movements, and thereby prevent any of the parts connected with the sectors from moving, unless by the application of a force superior to the friction; whereas the evener opposes the mechanical obstacle of a bar of iron in opposition to the movement of the heddle levers, and has itself to be moved by a movement corresponding with the movement of the heddle levers, in order to permit them to be moved; thus involving mechanical appliances and motions, and relative arrangement of those

motions with the evener and heddle levers, in order to make a co-operative mechanism; all of which mechanical appliances and devices are dispensed with by the use of the brake on the sectors.

Int. 29. State whether or not you find anything in the loom represented by Model B which is the same, or substantially the same, or has the same, or substantially the same, mode of operation, as the evener in the loom represented by Model A.

Ans. I do not.

157 Int. 30. State whether or not you find anything in the loom represented by Model B which is the same, or substantially the same, or has the same, or substantially the same, mode of operation, as the spring latches or catches in loom represented by Model A.

Ans. I do not.

Int. 31. Do you know why the operation of the narrow loom, referred to by you, in your answer to 21st interrogatory, was stopped yesterday, at the Arlington Mills, while Mr. Browne, H. B. Renwick, Crompton, and Marshall, and others were present? If yea, please state the reasons.

Ans. It was stopped at my suggestion, because I found it was making considerable noise, as all looms do in rapid operation; and as the Marshall loom, which those gentlemen were examining, was close to it, I thought the noise might annoy them in their consultation and conference upon it, and suggested to Mr. Ball that it, the Thomas loom, had better be stopped for the present. He directed the operator to stop it, and then he, with Mr. Edward S. Renwick and myself, retired to some distance from both of the looms.

Int. 32. State whether or not the defendants' counsel, at the Arlington Mills, yesterday, made any offer to the complainant's counsel, as to operating, or permitting the operation in his presence, and that of his experts, client, and Mr. Marshall, of the Marshall loom, and the broad and narrow looms referred to by you; and whether or not they desired to see the same operated.

Ans. Mr. Ball, respondents' counsel, invited Mr. Browne, counsel for complainant, to have the Marshall loom and the broad and the narrow looms operated by either his expert, Mr. H. B. Renwick, or Mr. Geo. Crompton, complainant, or Mr. Marshall, or any one they might select, and tendered them the use of the power, for that purpose, with which the looms were connected, ready to be operated. Mr. Ball also invited them to go and see the broad loom, which was in another room, and witness its operation, and that of the narrow loom; all of which offers were declined by Mr. Browne.

Int. 33. State whether or not any examination of the Marshall loom, or the said narrow loom, was made yesterday at said Arlington Mills by the complainant's counsel, or his client or expert, or by said Marshall, or by any, and which of them.

158 Ans. They all of them examined both of the looms referred to.

Adjourned to 9 a. m., 15th inst.

SEPT. 15, 1866.

Cross-examination by C. Browne, esq.:

Cross-int. 1. Suppose the points of suspension of the jacks and the point of attachment of the rods to the outer ends of the lower series of heddle levers, in the Marshall reissue loom, to be in the same vertical line, and the pattern chain to be so arranged that the surfaces of its roller cams shall bear inside of that vertical line; will not the jacks be en-

gaged with, or disengage from, the lifter and depresser, by the action of the pattern chain and the elastic suspension of the jacks substantially as they now are?

Ans. The question admits of a number of mechanical interpretations in construction, which would be widely different from each other, and I would prefer to have before me a drawing or model of the construction in the mind of the counsel making the inquiry. I suppose, however, the question to assume that the lower heddle levers project no further from the side of the loom than the upper heddle levers, and that their points of connection with the jacks are in a vertical line, and that the pattern chain of cams is placed between the jacks and the looms, instead of outside the jacks, and that the point of connection of the lower end of the jacks with the lower heddle levers is the same as it now is with the outer prong of the jacks. In that case there would still be the oblique, elastic connection from the lower heddle lever to the outer prong of the jacks. It would merely be changed from an oblique connection outwards to an oblique connection inwards. Now, the pattern chain of cams, being placed upon the opposite side of the jacks from where it now is, will operate in antagonism to the operation of this reversed oblique connection; and if the centres of the lower heddle levers were thrown further in towards the middle of the loom, to compensate for the change thus made in the length of the lower heddle levers by bringing in the point of connection towards the side of the loom, the mechanism would work, and be substantially the same as it now is; it would be a mere transposition of the parts. There would be no change in substance, either in the connecting devices or pattern chain of cams and jacks or their mode of operation. If the question supposes
159 the jacks to be connected by a forked connection from both of the lower prongs to the ends of the lower heddle levers, shortened, as I have before assumed in answering this question, so as to make a perpendicular tension upon the jacks, it would make no difference upon which side of the jacks the pattern mechanism be placed, because the jacks would always be held by the connecting mechanism in a straight line, or nearly so, and the cams of the pattern chain would act antagonistically to the elasticity of such a connection. The action of the jacks, under such circumstances, would be more uncertain, owing to the absence of the oblique connection, but the mechanism might operate imperfectly if the connections were under great strain. But the operation would not be substantially the same as it now is with the oblique connection, because the element of the oblique connection being left out, its superior capacity for moving the jacks laterally would be absent from the supposed combination. The combination, as it now is, acts by the elasticity and the oblique or diagonal nature of the connection. The combination with vertical suspension through the centre of the jacks only acts by elasticity of the connection.

Cross-int. 2. Suppose the brakes in the Model B to be removed, and the sectors to be in such a position that the concentric portions at the end of the slots shall embrace the friction rollers on the ends of the short arms of the vertical heddle levers, can the heddles then be moved by power applied to them (the heddles)?

Ans. They cannot, if the cam slots be thrown to and held perfectly at the extreme limit of their extent of motion. But from the jar of the loom in practical operation, this is not certain, and so uncertain is it, that in the practical operation of the loom with concentric portions, the concentric portions do not so thoroughly embrace the roller on the short arm of the vertical heddle levers as to prevent them from being moved

by power applied to them. In the practical operation of this mechanism, unless a greater pressure be put upon the brakes than is requisite for the operations of the loom, the sectors rebound a little, so that the concentric portions do not, in practice, embrace the roller sufficiently, in my opinion, to prevent the heddle levers from being moved by power applied to them.

Cross-int. 3. Will you please to suppose (as my question does)
160 that the sectors are in such a position that the concentric portions at the ends of the slots do embrace the friction rollers on the ends of the short arms of the vertical heddle levers, omitting (as my question omits) any reference to any jar tending to displace them, and answer the question whether the heddles can be moved by any force applied vertically to them. Please answer that question, "yes," or "no," if you can.

Ans. In making my last answer, I overlooked the supposition of the brakes being removed in the question. If the brakes were removed from the sectors in Model B, the weight of the jacks and sectors is such that the concentric portions in one end of the cam slots cannot be maintained in the relation described in the question, and therefore I cannot answer it "yes" or "no." It requires the brake to keep them in such relation. I refer to the position of the concentrics in the cam slots, when the jacks are in their elevated positions.

Cross-int. 4. Please to suppose (as my question does) that the sectors are in the position which my question describes, and that then force is applied vertically to the heddles. Can they be moved vertically by that force? Answer "yes" or "no," if you can.

Ans. I can't; because in order to suppose the sectors to be in such position as the question assumes, I must have before me such construction as may be in the minds of the counsel, which would enable them to maintain such position until I could apply force to the heddles. If the machine were to be made as it is not made, it would probably operate as it does not now, and cannot in its present condition, modified, as assumed in the question by the removal of the brakes. If the question be limited to one series only of the concentric portions of the cam slots instead of both series, viz., that series which operates upon the roller of the short arm of the heddle lever, when the jacks are in their depressed positions, I can answer it categorically.

Cross-int. 5. Will you take hold of the front cam sector in Model B (that one from which the brake is now removed), and move that cam sector until the friction roller is brought into the concentric slot, which operates upon that roller when the jack is in its elevated position, and hold that cam sector in that position until you apply force to the heddle to carry it in the opposite direction, or towards the centre of
161 the shed, and then let go of the cam sector and continue to apply that force to the heddle, and say whether it will move the heddle or not.

Witness says: What will move the heddle?

Counsel for complainant. The force which you so apply to it.

Ans. That depends upon the degree of force applied to the heddle. In loom represented by Model B, the weight of the heddles is not counterbalanced by anything between them and the concentric portions of the cam slot; therefore, the weight of the heddle leaves connected with the vertical heddle levers at the side operates antagonistically to the strain of the warps when the jacks are in their elevated position assumed in the question, and the degree of force which can be exerted by the strain of the warp threads upon the heddle levers, and through them

upon the surfaces of the series of concentric portions of the cam slots, that embrace the rollers of the short arms of the heddle levers when the jacks are in their elevated positions, is mechanically immaterial, and would not, in the practical operation of the loom, in my opinion, be sufficient to hold the sector by its bite of the roller in such concentric portion, from going back, after it was released from the hold of my hand, which would be necessary to keep it in position until I applied force to the heddles. I can, in this model B (which is merely an illustration of the mechanism of the loom), apply sufficient force to the heddles to keep the concentric portions from travelling away from the rollers when I cease to hold the sectors up by my hand, and this must be obvious to anybody who will try. But as I do not suppose the question to be directed to mere manipulations of the model outside of the practical operation of the loom represented by it, I find, on applying such slight force, as I consider equivalent to the force exerted in that direction through the heddles in the practical operation of the loom, and relieving the periphery of the cam sector, not only of the brake, but of the brake-spring, which tends to spring down upon the sector when the brake-shoe is removed, that the heddles will move under such circumstances, especially if I imitate in a very slight degree the tremble caused by the concussion and violent motion of the parts of the loom in weaving.

Cross int. 6. In the position of the parts assumed is there not
162 between the acting concentric portion and the leaves of heddles the short arm of the heddle lever and the friction roller attached, acting by their aggregate weight to counteract the weight of the heddles to some degree? Answer "yes" or "no," if you can.

Ans. Yes; I took that in mentally in my answer, but it has such slight effect that I did not consider it of sufficient consequence to make special mention of it. The weight of the heddles, leaves, straps, etc., of a practical loom is much greater than the weight of this little thin arm and roller, that I consider it would be ridiculous to take it into account. The small weight of this short arm and roller I do not think equal to the friction of the joints of the axis of the heddle levers and the axes of the guide rollers of the connecting strap; which friction operates antagonistically to the upward movement of the heddle assumed in the question. The weight of the short arm and its roller must be, small as it is, divided by 2 in estimating its effect in raising the heddle, because in the levers in this model the short arm is less than half as long as the long arm which operates on the heddle; and in practical looms the disparity is still greater.

Cross-int. 7. Will you now answer the 3d cross-interrogatory, supposing the friction roller to be in that concentric portion which operates upon the roller when the jack is in its depressed position?

Ans. With the jacks in the depressed positions, so far as I see, the heddles cannot be moved by force applied to them when the rollers on the short arm of the heddle levers are completely embraced by the concentric portions of the series of concentric portions of the cam slots which operate when the jacks are in the depressed position.

Cross-int. 8. Is this true also, supposing the parts to be under the jar consequent upon the ordinary operation of the loom?

Ans. It is true in fact—that is, the result is the same; but it is by reason of the weight of the jacks and the weight of the weighted or solid portion of the cam sector upon which the cog teeth are placed, and not by reason of any power in the concentric portion of the cam slot to resist displacement by the jar of the loom.

Cross-int. 9. Is there not in Model A applied to each latch a spring

to keep that latch from displacement while holding a jack, and consequently a leaf of heddles, up or down?

163 Ans. There is in Model A a spring applied to each catch, but not solely for the purpose mentioned in the question. The catch would resist displacement, if fixed. The spring is put upon it to enable it to be forced back by the cam on the shoulder of the jack, as the jack is moving up or down, and then to throw it in under the shoulder of the jack. When thrown in, the spring of course holds it for the purpose of permitting displacement by movement of the jack. It also holds the latch in place when the jacks are not moving.

Cross-int. 10. In loom represented by Model B, when the heddles are up or down, what is the force tending to move them down or up towards their mean position, respectively, supposing the lifter and depresser to be removed, and excluding the weight of the sectors?

Ans. When the leaves of heddles are up, their own weight and the weight of the portions of the warps they control and the strain of the tension of those warp threads and the weight of the straps and connections tend to move them down. This tendency, however, is more than overcome by the friction of the brake; and therefore there cannot be said to be any force operating practically to move the heddles down. When the heddles are in their depressed positions, there is no force that I know of, under the assumption of the question, tending to lift them up, except the strain of the tension of the warp threads controlled by them, except the trifling weight of the jacks; which, being connected with the sectors, may, under the assumption of the question (which excludes the weight of the sectors), be left out of consideration. The weight of the warps and leaves of heddles controlling them, and the straps and connections of the same with the heddles, taken together with the friction of the brakes, is a force so much greater than the tension of the portion of the warp threads, controlled by the heddles when down, that there cannot be said to be any practical mechanical force operating to lift the heddles up to their mean position.

Cross-int. 11. In loom represented by Model A, when the heddles are up or down, what is the force tending to move them down or up, towards their mean positions, respectively, supposing the lifter and depresser to be removed?

Ans. In a practical loom, as is represented by Model A, in order
164 to give the mechanism its proper effect, the weight of the heddles and connections must be counterbalanced by the weight of the jacks and connections of the other side of the centre of oscillation of the heddle levers; therefore it is the strain of the tension of the warp threads alone which tends to draw the heddles to their mean positions.

Cross-int. 12. If not counterbalanced, would the weight of the heddles and warp threads and connections assist to carry down the heddles?

Ans. Of course it would; and the effect of it would be—(counsel for complainant requests the witness to answer his questions)—to lift the jacks from the upper series of the spring catches.

Cross-int. 13. When the heddles are up, are not the jacks under the lower series of spring catches? Please look at the model and see.

Ans. They are; but the heddles are equally heavy when they are down and the jacks controlling them on the upper series of spring catches, and the question I answered last (as I understood it) referred to all the leaves of heddles, both up and down.

Cross-int. 14. Do you mean to say that when I asked you whether the weight of the heddles assisted to carry them down, you thought I meant heddles which were already down? Please answer that "yes" or "no," if you can.

Ans. I did not have any special train of thought on that occasion in reference to the particular point now inquired of. I considered the question to refer to the weight of the heddles, taken as a whole, and its effect upon their movement; and as the weight of the heddles of those that were down, would, if not counterbalanced, tend to carry them still further down, I stated the effect of it in my answer, in order not to be misunderstood.

Cross-int. 15. Now (omitting, if you please, the effect stated by you in your answer to 12th cross-interrogatory, about which effect you were not asked), if the weight of the heddles and warp threads and connections, when not counterbalanced, would assist to carry down the heddles, do they not, when counterbalanced, tend to carry them down—such tendency being resisted by the counterbalance?

Ans. I don't think they tend to carry them down, if counter-
165 balanced, because the counterbalance prevents such tendency, and is put there for that purpose. The forces are neutralized.

Cross-int. 16. In Model A, when leaves of heddles are in their elevated and depressed positions, respectively, and a force sufficient to overcome the counterbalance is applied to them to move them towards their mean line, what is it that resists that force?

Ans. The evener, which lies across the ends of the upper series of heddle levers, and, by presenting a mechanical obstruction, prevents the movement of the heddles up or down.

Cross-int. 17. Suppose the evener to be out of the loom?

Ans. Then the spring catches, assisted by the pattern chain and oblique connections, will hold them, except when the jacks are thrown off the spring catches, prior to shifting the shed.

Adjourned to 10 a. m., Monday, 17th.

SEPTEMBER 17, 1866.

Resumed:

Cross-int. 18. Look at the sketch now shown to you, marked "Complainant E." "N. A. P., Examiner," which represents a sector with two notches cut in its periphery, and the spaces between the notches cut away, so that the sector is of so much less circumference at that portion as to be beyond the reach of the springs, and also two stationary bars in the loom, each fitted with a half-elliptic spring, secured to it by staples, the construction being such that one spring or the other will enter one or the other of the notches, when the heddles are fully up or fully down, and will hold the sectors, and, consequently, the heddles in position (supposing the slots to be without concentric portions); and say whether if sectors and springs like that were substituted for those now shown by Model B, it, Model B, would then contain, in your opinion, substantially the same, or sustantially a different, combination from that which it now does for forming and shifting the shed.

(Objected to.)

Witness inquires: Is the brake to be dispensed with in the combination inquired of, of which Exhibit E is to form a part?

Counsel for complainant. Please answer both ways, assuming it first to be present, and aftewards to be absent.

(Objected to.)

Witness inquires: How is the brake to be used in connection
166 with the parts shewn in Exhibit E? I cannot answer under the assumption that the brake is to be used with those parts, without being informed in what manner it is to be used, unless I am at liberty to

assume some way of using it not shown in the drawing presented to me.

Complainant's counsel. Please, then, take, in the first instance, the apparatus without the brakes.

(Objected to.)

Ans. In my opinion, the Model B, so altered, would not contain substantially the combination it now does for forming and shifting the shed. But if you put a brake in, no matter how, so as to operate upon the sectors, as the brake does in Model B, the Model B would then contain substantially the same combination, and also the addition of a double series of spring catches upon the sectors, which would be of no use, but, inasmuch as it was an additional mechanism in the combination, so far as it went, would be substantially different.

Cross-int. 19. What part of the functions of the brake in Model B is not performed by the half-elliptic springs, when brought to bear upon the protuberant parts of the sector, as shown in Exhibit "E?"

(Objected to.)

Ans. All parts of it—for the reason that the function of these spring catches, shown in Exhibit E, is not the function of a brake-shoe, which is simply the appliance of friction by pressure to parts so formed as not to oppose mechanical resistance to their movement; whereas, in these spring catches the mechanical resistance of an inclined plane is the main dependence, and not friction. If the protuberances, shown in the sector in Exhibit E, were cut off, and the surface upon which the springs operated were a concentric curve, as in the sectors of Model B, there would be no material friction; if there were, so far as it went, it would then have the function of the brake and the brake-shoe at the places upon which it bore, but upon the places between the two extremities of motion there would be no bearing, and there would be no function of the brake-shoe performed, as in Model B, to retard by friction the lurching of the parts.

Cross-int. 20. Is the function of the brake-shoe, in Model B, as it acts upon the sectors at the extremities of their motion, to hold the sectors in position?

Ans. The result of the exercise of its function is to hold them in the position they may be left at any time in the operation of the
167 machine; but its function is simply to apply frictional pressure to the periphery of the sectors.

Cross-int. 21. Is the result of the exercise of the function of the springs shown in drawing, Exhibit E, so far as they make friction on the surfaces upon which they bear, to hold the sectors in the position they may be left in the operation of the machine?

(Objected to.)

Ans. I think not; for the reason that if the sectors should be left, in the operation of the machine, a little out or in from the position in which they are to be held by the springs in Exhibit E, the action of the springs would move the sectors, instead of holding them in the position in which they might be so left, until the spring fell equally between the two protuberances. When in that position there would be no necessity in the construction shown in Exhibit E, for any frictional pressure of the spring upon the convex surfaces between the protuberances of the notches shown in that exhibit. It would be sufficient for the purpose of holding in those positions if the curved part of the spring merely fell into the notch, so as to oppose, by the protuberances of the notches, the movement of the sectors. In such a contrivance as is shown in Exhibit E, were the springs pressed into the notches, so as to make friction, the first effort of moving the sector would be to bring the mechanical feature of the in-

clined plane into action to resist the movement, and not to bring any frictional resistance, except such as is inseparable from the movement of the inclined plane against the spring, which occurs in all cam motions of the like nature. Thus, while the parts would not be held by friction in such case, although friction were made, the movement of them would be opposed by such friction, as the inclination of the protuberances of the sectors in each side of the springs would create by their motion.

Cross-int. 22. I do not see that my question is answered. Will you examine it again, and answer it directly, if you can?

(Objected to.)

Ans. I cannot make a better answer to it. The first part of my last answer is a direct answer. The next contains my reasons, and an explanation of the operation of the parts.

Cross-int. 23. Assuming that the sectors are not left, as the reason given in your last answer assumes that they are left, a little in or out from the position in which they are to be held by the springs in
168 Exhibit E—that is to say, assuming that the sectors are at their extreme position, and not a little out of it either way—will you answer the question, whether or not the result of the exercise of the function of the springs, shown in drawing Exhibit E, so far as they make friction on the surfaces upon which they bear, when the sectors are at such extreme position, is to hold them at that extreme position.

(Objected to.)

Ans. I don't think the friction of the surfaces has any material mechanical effect whatever in the condition of things specially described in the question. It is the mechanical obstacle of the protuberances, or projections, which embrace the curved spring on both sides of it, which holds the sectors in their positions when the springs are embraced by the notches; and, as have I before said, the friction arises and operates only when the sectors are attempted to be moved, so as to move the protuberances along the surface of the spring. I wish to be distinctly understood, in order to avoid further questions involving explanations, that in the operation of the contrivance, shown in Exhibit E, it is the direct mechanical antagonism of the spring and protuberances that holds the sectors, when the spring is embraced by the notches, and not friction.

Cross-int. 24. In the arrangement shown in drawing marked E, is the result of the exercise of the function of the springs and notches to hold the sectors at their extreme positions, supposing the springs to bear on the bottom of the notches, as the drawing shows?

(Objected to.)

Ans. It is. But in one position of the sectors—that is, when the jacks are down—it would be a superfluous operation, because the sectors are already held in that position by the weight of the cog portions of them, supposing there were to be no concentric portions in the cam slots, as was supposed in the first of this series of questions, wherein the combination of mechanism referred to in the last question was more particularly described. Thus, one of the series of springs and notches, shown in the drawing Exhibit E, would be useless, and a mere piling up of mechanical devices without purpose.

Cross-int. 25. Suppose the spring latches to be removed from Model A, and brakes to be applied, with or without notches, to the peripheries of the collars through which the upper series of heddle levers
169 pass, being the construction exhibited in model now shown you, marked Exhibit F, and state whether, in your opinion, the combination of mechanism for forming and shifting the shed would be sub-

stantially similar to, or substantially different from, that now shown in Exhibit A.

(Objected to.)

Ans. In my opinion, if the construction of this Exhibit F were applied to the heddle levers in Model A, and the spring catches were removed from the loom and jacks of that loom, the loom represented by Model A, when so changed and altered, would not contain substantially the same combination of mechanism for forming and shifting the shed as it now does; neither would it contain substantially the mode of operation by which the shed is formed and shifted in the loom represented by the model as it now stands. For the reason that the holding mechanism would have a substantially different construction, and also a substantially different mode of operation in combination with the other parts of the mechanism for forming and shifting the shed, the pattern mechanism would no longer co-operate with the holding mechanism to enable it to hold the jacks up and down, neither would the connecting mechanism co-operate with the spring catches to enable them to hold the jacks up and down; the shed would not be held open by means applied to the jacks, or depending in any way upon the lateral motions of the jacks, as in the operation of the spring catches in Model A, as it now is. These reasons will apply to either of the constructions shown in Exhibit F, or both, if used together. But there is a substantial difference between the two constructions shown in Exhibit F, one form having notches in which a spring drops, the action of which notches and spring is mechanically and substantially different from the action of the brake-shoes and smooth rims which constitutes the other form shown in Exhibit F. The loom, so altered, would still retain one of the essential characteristic peculiarities of its jacks, viz., the shoulders on the outside of the jacks, and their inclined cams, which would, however, be utterly useless in the new form of construction, they no longer being required to engage with a double series of spring catches, either to force them back or to be held by them. This is shown very plainly in the model Exhibit F. Another substantial difference between the two constructions, in my opinion, would be that, instead of the double series of spring
170 catches required, when applying spring catches to jacks substantially in the manner shown in Model A, but a single series of spring catches would be required, when using the spring catch upon the collar of the heddle lever as shown in Model F. In the construction shown in Model F, the spring catch is substantially different from the spring catch in Model A, which latter requires a lateral movement of the jack in order to release it from the spring catch, so that the heddle can be moved. The spring catch in Model F is self-releasing, and requires no lateral movement of the jack for the purpose of releasing it, and is not released by the lateral movement of the jack before the heddles are begun to be lifted, but only by the oscillation of the heddle levers in consequence of the perpendicular movement of the jacks, and at the time when the heddles are being moved.

Direct examination resumed by J. D. Ball, esq.:

Int. 34. Will you please explain a little more fully your answers to the 12th and 13th cross-interrogatories?

Ans. In the condition of the loom supposed in the questions referred to, viz., that the weight of the warp threads, leaves of heddles, and harness was not counterbalanced, the action of the tension of the warp thread, when the heddles were down, to raise the heddles would be opposed by the weight of the warps and heddles, and the effect of such

opposition of weight would be to carry the heddles further down than they would go if counterbalanced, and the effect of the heddles going further down would be to lift the jacks higher up than their required position to engage with the upper series of spring catches, which are fixed in their positions relatively to the movement of the jacks. Now, when the parts are counterbalanced, the strain of the warp threads, held down by the heddles, tends to, and does, keep the jacks down upon the upper series of spring catches, so that the spring catches hold them from going further down, and the heddles attached to them from going further up; but if the parts are not counterbalanced, the weight of the warps and heddles and connections would be sufficient, in my opinion, in a fancy loom, weaving such fabrics as are ordinarily woven in
171 such looms, to lift the jacks enough higher than their required elevated positions to release them from contact with the upper series of catches; and if they released them by a hair's breadth, or to any degree, so that the shoulders of the jacks did not rest on the upper series of spring catches, that part of the shed would be held open, not by such upper series of spring catches, but by the weight of the harness, when the jacks were in their extreme elevated positions. It follows, therefore, that in order to have the operation of the upper spring catches, the parts must be counterbalanced, so that the strain of the tension of the warp threads, which are held down, may cause the heddles to bear upwards, and consequently the jacks to bear downwards upon the upper series of spring catches. When the heddles were up and the jacks down this action would be reversed, and the weight of the heddles and the weight of the warp threads, not being counterbalanced, would then tend to carry down the heddles and to lift the jacks up against the lower series of spring catches, which would not be the case if counterbalanced; the strain of the tension of the warp threads would then be the force employed in moving the heddles down and lifting the jacks up, throwing out the action of the lifters and depressers, as assumed, I believe, in the commencement of the series of questions, of which the two now referred to form a part.

Int. 35. Suppose that what is assumed in the 3d cross-interrogatory to be a fact was a fact, to wit, that the sectors in the loom represented by Model B were put in such position that the concentric portion at the ends of the slots did embrace the friction rollers on the ends of the short arms of the vertical heddle levers, will you then state whether in such positions the concentric portions would prevent the movement of the jacks either up or down, and your reasons?

Ans. They will not; for the reason that those portions are concentric, and therefore do not oppose any mechanical obstacle to the vibration of the sector when the jack is moved, as I have several times, in the course of this examination, explained. When the jack is moved, it moves the sector, and the concentric portions of the sector being in a circle, the centre of which is the centre of motion of the sector, do no not oppose any mechanical resistance to the movement of the jacks and sector.

F. C. TREADWELL, JR.

Adjourned to Wednesday, 19th inst., at 10 a. m.

172 *Deposition of Robert Davis, taken, subscribed, and sworn to, before N. Austin Parks, esq., examiner, Sept. 20th*, 1866.

Int. 1. State your name, age, residence, and occupation.

Ans. Robert Davis; age, 26; residence, Lawrence, Mass.; occupation, weaver.

Int. 2. State whether or not you are in the employment of any person or corporation; and, if yea, how long you have been so employed, and in what capacity, and where.

Ans. I am in the employ of the Washington Mills, at Lawrence, Mass. I have been employed there six years and nine months, at first as a loom-fixer for two years; for the next two years as second hand in the weaving department; and two years and two months overseer of the weaving room; and the rest of the time I was employed in the finishing department, which was before my employment as loom-fixer.

Int. 3. Before entering the employment of the Washington Mills, were you employed as weaver; and, if so, where, and how long?

Ans. I was; by the Pemberton Co. of Lawrence, from August 17th, 1856, till January 10th, 1860. Before I went there, I was a weaver in Alleghany City, Penn., for six months. Before that I worked in Dedham, Mass., for three months, and before that in Mobile, Alabama, for fourteen months, previous to which I had been employed as weaver in various places for about four years.

Int. 4. State what generally have been your duties as second hand and overseer of the weaving at the Washington Mills.

Ans. To look after the work generally, while second hand, under the direction of the overseer, and, when overseer, to hire and discharge help, keep everything in order, and see that the work is properly done, being responsible for so much work.

Int. 5. Please state whether or not you have used, at the Washington Mills, any of the looms known as the Thomas looms; and, if so, how many, and for about how long?

173 Ans. We have used about forty-three, for about three years and a half.

Int. 6. How, in respect to their mechanical construction, do they resemble the loom Model B, so far as the mechanism is in that model represented?

Ans. They are like this.

Int. 7. How, with reference to practical weaving, have said Thomas looms operated; successfully, or how otherwise?

Ans. They have operated successfully.

Int. 8. Whether or not said Thomas looms have or have not given satisfaction in their practical operation?

(Objected to.)

Ans. They have.

Int. 9. State whether or not, previously to being employed by the Washington Mills, you operated any looms of the same kind, known as the Thomas looms, and where, and about how many?

Ans. I did, at the Pemberton Mills; thirty-two.

Int. 10. Please state how those which you operated at the Pemberton Mills worked in practical weaving, whether successfully or how otherwise.

Ans. They operated successfully.

Int. 11. Please state whether or not you have noticed in the practical operation of said Thomas looms at the Washington Mills, any, and if any, what results, when the friction brakes on the cam sectors have got broken or been removed.

Ans. The harnesses invariably would come together.

Int. 12. Please state what you mean by "coming together."

Ans. The shades are open, and, when the friction is off the cam, the harnesses would come together in the centre.

Int. 13. What effect would that have upon throwing the shuttle?

Ans. The shuttle might run under or over, but it wouldn't make any cloth; or it might stop in the centre of the warp.

Int. 14. In those looms in which you noticed that result when the friction brakes became broken or were removed, did or not the slots in the cam sectors have concentric portions, as shown in Model B?

Ans. They did.

Int. 15. State whether or not, in the practical operation of said Thomas looms, which you have witnessed at the Washington Mills, the
174 roller on the arm of the heddle levers is or is not embraced by the concentric portions of the slot in the sectors.

Ans. Sometimes it is and sometimes it isn't.

Int. 16. Is there any difference in the character of the work produced in the two cases?

Ans. None.

Int. 17. Please state whether or not you witnessed any operations at the Arlington Mills, in said Lawrence, on one of the Thomas looms having concentric portions in the cam slots, and any operations on the same loom with the concentric portions removed from the cam slots, and state fully what those operations were in the two cases, and who were present.

Ans. I witnessed an operation on a loom there with concentric portions of the cam slots, and on the same loom an operation without the concentric. There were present E. S. Renwick and F. C. Treadwell, jr. The operation without the concentric was as good as that with the concentric. I could see no difference.

Int. 18. Can you identify one of the cam sectors which was used in that loom at the time it was so operated, having no concentric portions in the cam slots?

Ans. Yes; this is one. It is marked "Defendant No. 1, R. E. S., Examiner."

Int. 19. Who ran said loom while it was so operated?

Ans. I did.

Int. 20. What was the kind of work that you operated it on with the concentric portion in the cam slots, and also when the concentric portions were removed from the cam slots.

Ans. Heavy Esquimaux beaver in both cases, with the same warp.

Int. 21. How did that Esquimaux beaver, in respect to being heavy, compare in the degree of heaviness with other work produced on looms?

Ans. I think it is the heaviest work that we make almost, or as heavy as any; the hardest weaving.

Int. 22. Was the loom that you so operated at the Arlington Mills a broad or a narrow loom?

Ans. A broad loom.

175 Int. 23. Did you witness any operations at said mills on a narrow Thomas loom without any concentric portions in the slots in the sectors; and when did you witness the same, and how did the loom work?

Ans. I did; on the 29th and 30th of August last. The loom worked well—perfectly.

Int. 24. State whether or not you witnessed any operation at said Arlington Mills of a loom called the Marshall loom, and, if so, when, and what the operations were.

Ans. I did; on the 29th and 30th of August last. The operations on the Marshall loom were made with the evener on and the spring catches, when a shed could be formed sufficient to allow the passage of the shuttle through the warp. I also saw it operate with the evener off, in which case a shed couldn't be formed to admit of a full passage of the shuttle.

The shuttle would stop. The shed would fall together before the shuttle could pass through.

Int. 25. State how many such looms as said Marshall loom you ever saw.

Ans. This was the only one I ever saw.

And in answer to cross-interrogatories propounded by C. Browne, esq., deponent saith as follows, viz:

Cross-int. 1. How many looms in all are now in the Washington Mills?

Ans. Six hundred and eighty woollen looms; four hundred and four cotton looms, as near as I remember.

Cross-int. 2. Of what kinds, other than the Thomas looms, are these six hundred and eighty woollen looms?

Ans. What we call the medium, the broad cam, the Atlantic, narrow cassimere looms, and narrow Crompton fancy loom, so called.

Cross-int. 3. How many Crompton fancy looms in all are there in the mill, whether broad or narrow?

Ans. I think thirty.

Cross-int. 4. How many cam woollen looms in all?

Ans. I should think not far from three hundred broad; there
176 may be more. I can't say positively. I think there are ninety narrow.

Cross-int. 5. Leaving out the Thomas looms and the Crompton looms, broad and narrow, and the cam looms, broad and narrow, of what kind or kinds are the remaining woollen looms? Give the manufacturer's or patentee's names to identify them.

Ans. I don't know of any others.

Cross-int. 6. Are there in the Washington Mills any open-shed looms except the Thomas?

Ans. No.

Cross-int. 7. When were these Thomas looms brought into that mill?

Ans. The first were brought in about six years ago. They came at intervals during two or three months—two, three, or four at a time—forty-one of them, I think, in that time. There are forty-three in my room; that's what I meant in my answer to the 5th direct interrogatory. There were 148 in all.

Cross-int. 8. When did the last batch of Thomas looms come into that mill?

Ans. Two years ago this fall or winter—late in the fall or early in the winter.

Cross-int. 9. Have they put in any woollen looms in the Washington Mills within two years?

Ans. No, sir.

Cross-int. 10. What manufacturer's mark is on the Thomas looms in the Washington Mills?

Ans. Gould's, Lake Village, New Hampshire, I think; I can't be certain.

Cross-int. 11. How long were you at the Pemberton Mills?

Ans. From July, 1856, to January 10th, 1860.

Cross-int. 12. How many Thomas looms were there when you left?

Ans. The mill fell down in 1860. At that time there were probably two hundred there.

Cross-int. 13. How many of all other looms doing the same class of work that the Thomas looms were doing?

Ans. All the looms in the corporation were built by Thomas except eighty drilling looms.

177 Cross-int. 14. When you say that at the time the mill fell down in 1860 there were probably two hundred Thomas looms, do you mean open-shed fancy looms?

Ans. I do.

Cross-int. 15. Besides the eighty drilling looms and the two hundred open-shed Thomas fancy looms, were there any looms in that mill at that time?

Ans. I think about four hundred side-cam looms.

Cross-int. 16. Making fancy cottons?

Ans. Making sheetings and drillings and cotton flannels.

Cross-int. 17. Have you been in the Pemberton Mill since it was rebuilt?

Ans. I have.

Cross-int. 18. When?

Ans. I was there two or three months ago.

Cross-int. 19. Did you see any open-shed Thomas fancy looms there then?

Ans. Yes, sir; I did.

Cross-int. 20. How many?

Ans. I couldn't say. I should think a hundred and fifty.

Cross-int. 21. How many looms were there in the Pemberton Mills of all descriptions besides these open-shed Thomas fancy looms?

Ans. Probably four or five hundred.

Cross-int. 22. What are the names of the other overseers of weaving rooms at the Washington Mills?

Ans. Jonathan Mercer, Wm. Wisner, A. F. Clark, D. H. Kelly, and Winslow Eager, overseer of cotton weaving, all of Lawrence.

Int. 23. Did you see any Crompton fancy woollen looms when you were in the Pemberton Mills two or three months ago?

Ans. Yes, sir.

Int. 24. How many of them?

Ans. Probably twenty-five or thirty.

Int. 25. Bearing the mark of Geo. Crompton, of Worcester?

Ans. I don't know; I didn't see the mark on them.

Int. 26. Do you know when they were put into the mill?

Ans. Six or eight months ago.

178 Int. 27. You were asked in 11th direct interrogatory what resulted when the friction brakes on the cam sectors of the Thomas looms got broken or were removed; what caused them to break when they did break?

Ans. Sometimes in putting a warp in, of ten or twelve harnesses, different from what we had been weaving before—a different fabric—the section hand, in adjusting the friction, was apt to get on more friction than was necessary, and the result would be that the castings would break that the screws were set in to set the springs.

Int. 28. What were the occasions of these brakes being removed?

Ans. On light work we don't require so much friction on the cam as we do on heavy work to hold the harness in its place.

Int. 29. In doing that light work, did you take off the friction of the brakes entirely?

Ans. No; we couldn't weave without it.

Int. 30. I asked you just now what were the occasions of the brakes being removed; please answer that question.

Ans. On heavy work it requires more friction to hold the cam, and the more we get on the harder the loom is to drive. On light work we ease it off in order to let the loom go as easy as possible.

Int. 31. But what are the occasions of the brakes being removed?

Ans. They were not removed. The brakes were still there, but there was less tension on them.

Int. 32. But you said on your direct examination that when the friction brakes were removed, the harnesses invaribly would come together in the centre; when that took place, would the loom weave?

Ans. The loom would run, but it wouldn't make any cloth.

Int. 33. Now, I am not speaking of running on light goods when the friction was merely eased up, but I am speaking of what you were speaking of when you said, that when the brakes were removed the harnesses invariably came together in the middle—in which case, as you say, no weaving could be done; what were the occasions of the brakes being so removed?

Ans. They were removed by the breaking of the casting that held them.

179 Int. 34. What makes the shades immediately come together in the middle when not held in their up or down position?

Ans. The tightness of the warps will draw them to the centre.

Int. 35. Does this tightness of the warps tend to draw them strongly towards the middle?

Ans. I never tested the strength of the tightness.

Int. 36. You said in your direct examination that sometimes the rollers on the arms of the heddle levers were embraced by the concentric portions of the slots in the sectors and sometimes they were not; do you mean that sometimes you used the loom one way, and sometimes used it the other?

Ans. Yes.

Int. 37. When the looms were used without having the friction rollers embraced by the concentric portions of the slot, were you working with a less amount of shed than in the other case?

Ans. Yes.

Int. 38. When you are so working with a less amount of shed, do you tighten up the friction on the cam sectors?

Ans. Not always.

Int. 39. When do you and when do you not, in working with a smaller shed?

Ans. I don't know of any other way than that sometimes a little oil will get on the friction, or the work may be a little heavier than was formerly in the loom.

Int. 40. Do you mean that when you weave heavy goods with a small shed and without having the friction rollers embraced by the concentric portions in the slots, you tighten up the friction or the cam sectors?

Ans. We do, in consequence of the work being so much heavier that the tension of the shades tend to draw them more strongly to the centre.

Int. 41. Is this the case also on goods of medium weight, working without the friction rollers in the concentric portions?

Ans. Yes.

Int. 42. Is it the case also in weaving goods of light weight when there is a little oil or grease on the friction?

Ans. If there was friction on the cam, it would not run so.

180 Int. 43. If there is enough oil or grease on the friction to prevent more or less its firm hold on the sector, do you not have to tighten up the friction more or less to compensate for this, even in weaving light goods?

Ans. Yes.

Int. 44. How does oil or grease get on to the friction?

Ans. By carelessness of the section hand in oiling the loom sometimes; sometimes from the carelessness of the weaver.

Int. 45. What is the friction face on the brakes of the Thomas cam sectors made of?

Ans. Of cork.

Int. 46. Do you renew it; if so, about how often?

Ans. We do. Perhaps every two months—may be more or less.

Int. 47. Why is it renewed?

Ans. It gets worn off.

Int. 48. Does it, before it is worn off, wear gradually, so that the friction has to be tightened up from time to time on that account?

Ans. Yes.

Int. 49. Does the action of the oil or grease on the cork destroy it or injure it?

Ans. It injures it.

Int. 50. How does it injure it?

Ans. It injures it because the cam will slip easier than if it was dry or free from oil.

Int. 51. Do you ever have to do anything to this cork friction face besides renewing it?

Ans. No; I never have.

Int. 52. Will you describe particularly the operation, as it is performed under your charge upon the Thomas open-shed fancy looms in the Washington Mill, of changing the pattern on the pattern chain when required?

Ans. We take the chain off and take our pattern and reset it; or we can reset it on the loom without taking it off.

Cross-int. 53. As a general rule, you take the chain off?

Ans. We do.

181 Cross-int. 54. Describe particularly what you do after you have taken it off.

Ans. We get the pattern set, put it on, and start the loom again.

Cross-int. 55. Describe particularly all you do to set the pattern while the chain is off the loom.

Ans. We lay the chain on the bench, take a wrench used for the purpose of setting it, and open and close such holes as we want (as the pattern is marked out to be) on each link until finished.

Cross-int. 56. What is the operation of changing the pattern on the pattern chain in the Crompton fancy loom having spindles and rolls as shown in Model A?

Ans. You take the chain off, lay it on a rack used for the purpose—where they use Crompton looms—put the rolls in blanks in the place where the pattern has marked them out to be.

Cross-int. 57. About how much time is required on the average to go through the whole operation of dismounting the chain, resetting the pattern, and remounting the chain in the two cases?

Ans. I can't tell you; some would take three hours, some five minutes, according to the pattern. In the Thomas I could probably set six chains of the same number of links—the same changes—in the time I could set one of the Crompton.

Cross-int. 58. Did you have Crompton fancy looms in your weaving room?

Ans. No, sir.

Cross-int. 59. Do the buttons on the Thomas chain wear loose on the pivots sometimes?

Ans. They do; by the constant resetting of the chain, if they are not riveted each time—we always calculate to rivet them when we change the pattern—else the constant movement has a tendency to make them work loose on the pivots.

Cross-int. 60. Do the back counter-weights in the Thomas open-shed fancy looms always throw the jacks accurately into position as indicated by the pattern chain?

Ans. I don't use them.

Cross-int. 61. What do you use in those looms instead of the back counter-weights?

182 Ans. We use a spring.

Cross-int. 62. Do you mean a spring attached to the inner end of a bracket cast on to the outer counter-weight?

Ans. I do.

Cross-int. 63. Between which spring and the ear of the outer weight, which hangs down and shoves the jack inward, the jack stands?

Ans. Yes.

Cross-int. 64. When did you first see Thomas looms with this spring instead of the inner counter-weight?

Ans. About a year and a half ago, or two years.

Cross-int. 65. Were any Thomas looms in the Washington Mills altered by the substitution of this spring for the inner counter-weight?

Ans. Yes.

Cross-int. 66. How many?

Ans. Nearly all we had there.

Cross-int. 67. What was the difficulty about the use of the inner counter-weight?

Ans. Sometimes it missed throwing out a jack.

Cross-int. 68. Do you know of any other respects in which the Thomas looms have been altered since you first began to use them?

Ans. I don't think of any now.

Cross-int. 69. Notwithstanding the riveting up of the buttons every time the Thomas pattern chain is reset, do not the buttons, when the chain is used for a considerable time on one pattern of goods, wear loose on the rivets sometimes, and swing out of place?

Ans. No; not in my experience. I haven't seen it. We've some chains that have been run over a year and haven't been altered.

Cross-int. 70. Do you mean that no such thing as was mentioned in the last question has occurred with the Thomas fancy looms in the Washington Mills since you've been there?

Ans. No, I do not. Sometimes the section hand misses a rivet, and then they will get loose.

Cross-int. 71. But I mean, supposing he doesn't miss a rivet. Will they not then, or some of them, in continued use, get out of order?

183 Ans. Yes; by continued use the weight will wear a hole through the button, and that would make it out of order.

Cross-int. 72. You have known this to happen?

Ans. Yes, sir.

Cross-int. 73. In the Thomas fancy looms at the Washington Mills, can the lathe be operated by the weaver by hand with 20 or 24 harnesses?

Ans. No.

Cross-int. 74. Can it with a less number; if so, with what number?

Ans. No; we use a brake to hold it wherever it stops.

Cross-int. 75. Why can you not operate the lathe by hand in the Thomas fancy looms?

Ans. When the loom is stopped, the brake falls on to the band of the driving pulley and holds it there.

Cross-int. 76. Do you know whether or not, without that brake acting on the band, the lathe can be operated by the weaver by hand?

Ans. Yes; I suppose it could.

Cross-int. 77. At what speed do the Thomas open-shed fancy looms run in the Washington Mills?

Ans. They run at 76 picks to a minute.

Cross-int. 78. Since the springs were substituted for the inner counterpoise weights, have the jacks always been moved into position accurately, as directed by the pattern chain, in continuous use?

Ans. Yes; unless a nut should get loose and the racks that the jacks worked in slipped back—then they wouldn't.

Direct examination resumed by J. D. Ball, esq.:

Int. 26. At what speed do the Thomas open-shed fancy looms run in the Washington Mills as compared with other looms of the same width?

Ans. About the same in proportion to the width.

Int. 27. Please state whether or not the weaver on the Thomas loom can or cannot place the lathe in position for piecing up the warp threads, or changing the shuttle when the filling is out, as readily as in other fancy looms.

(Objected to as leading.)

184 Ans. We can.

Int. 28. Please state how, with reference to the readiness in placing the lathe in the Thomas loom in position for piecing up the warp threads or changing the shuttle when the filling is out, the Thomas loom compares with other fancy looms.

Ans. It is easier to place the lathes in the Thomas loom than in any other fancy loom that I am acquainted with, because you can do it with mechanical power, and in other looms you use physical power. You can't place the lathe on any other loom as you can on the Thomas loom. You must, in any other loom that I've seen or worked on, bring it forward or run it back.

Int. 29. State whether or not it is desirable for any purpose that the lathe in the Thomas fancy loom should be operated by hand?

Ans. No; it is not.

Int. 30. Comparing the pattern chain in the Thomas loom and that in the Crompton fancy loom, referred to in 56th cross-interrogatory, which is preferable, and why?

(Objected to.)

Ans. The chain of the Thomas loom is lighter and handier. That's the only advantage I know of over the Crompton.

Int. 31. Please state how the time required to alter the pattern on one compares with the time for altering the pattern on the other.

(Objected to.)

Ans. In the Thomas loom chain all that is required is to use the wrench to change the buttons. In the Crompton loom you have to take your spindles out and change the balls which are kept in by a pin at the end of the spindle. The Crompton loom requires more time than the Thomas for this purpose.

Int. 32. Please explain what you mean by the word "handier" in your answer to the 29th question.

Ans. I mean that you can take a link from the Thomas chain easier than from the Crompton, and in less time.

Int. 33. State whether or not you have recently made any examination of the Thomas looms in your room at the Washington Mills while they were in practical operation, with reference to the number in which the cam rollers in the cam slots of the sectors run into the concentric portions of the slots; and, if yea, what did you find to be the result of that examination?

185 Ans. I did; on Tuesday last. I found out of the 43 in my room that in seven of them the rollers ran into the concentric parts, and in the rest they did not.

Int. 34. How did the work on the 7 compare with that on the rest of the 43; was there any difference?

Ans. I couldn't see any difference.

Int. 35. In the practical operation of the Thomas looms at the Washington Mills, do you ever alter the friction on the friction-brakes for the purpose of having the cam rollers in the cam slots run into the concentric portions?

Ans. We do not.

Int. 36. State whether or not the concentric portions in the cam slots are or are not of any use.

(Objected to.)

Ans. They are not, in my opinion.

Int. 37. You stated in your direct examination that you were employed from August 17th, 1856, to January 10th, 1860, as a weaver at the Pemberton Mills; and in your cross-examination, that you were at those mills from July, 1856, to January 10th, 1860. Please explain about these dates.

Ans. The date should be July 17th, 1856.

Cross resumed by C. Browne, esq.:

Cross-int. 79. When did you first see a Thomas open-shed fancy loom with the counterpoise weight on the cam sector like that marked "Defendant No. 1?"

Ans. About four years ago, I think; can't say positively.

Cross-int. 80. Have you seen any within two years without such counterpoise weight?

Ans. No, sir.

ROBERT DAVIS.

Adjourned to 22d, at 10 a m.

186 *Deposition of Daniel H. Kelly, taken, subscribed, and sworn to, before N. Austin Parks, examiner.*

SEPT. 22, 1866.

Int. 1. State your name, age, residence, and occupation.

Ans. My name is D. H. Kelly; age, 36 years; residence, Lawrence, Mass; occupation, manufacturer.

Int. 2. State whether or not you are in the employ of any person or corporation; and, if so, what and how long have you been so employed, and in what capacity. Please state your duties when so employed.

Ans. I am employed in the Washington Mill, at Lawrence, Mass., and have been more or less for the past ten years. I went there the last time a year ago the last June. I am overseer of a weaving room. My duties are to take charge of the help, and generally oversee the weaving in that room.

Int. 3. Whether or not you are a practical weaver; and, if so, how long you have been such?

Ans. I am. I've had about six years' experience.

Int. 4. State whether or not you have worked the Thomas fancy loom; and, if so, where, and how long.

Ans. I have, at the Washington Mill, for two years and a half.

Int. 5. How many of said looms have you operated, and how many of them are in operation in that mill?

Ans. I have forty-one in my room at present; there are about one hundred and forty-eight of them in the mill.

Int. 6. Please state how, with reference to mechanical construction, said looms compare with Model B, so far as the mechanism is shown by said model.

Ans. The only difference I see is that in my loom there is a spring behind the jack, which is not in the model. It operates instead of the inner-weighted lever.

Int. 7. How have said Thomas looms operated, successfully or otherwise?

187 Ans. Successfully.

Int. 8. Please state as to the satisfaction or dissatisfaction that they have given.

(Objected to.)

Ans. They have given good satisfaction.

Int. 9. State whether or not you have witnessed the operation of any Thomas loom, at the Arlington Mills, with the concentric portions in the slots in the sectors, and any operations of the same loom without the concentric portions in the slots in the sectors, and state what those operations were, and the results, and when you witnessed the same.

Ans. I have witnessed both such operations. It was on the 30th August last. It was to weave heavy cloths, Esquimaux beaver; it worked successfully in both cases.

Int. 10. Was there any difference in the practical operation of the loom in the two cases?

Ans. There was not.

Int. 11. How did the material that you saw woven in the two cases compare?

Ans. The material was the same in each case.

Int. 12. How did the material woven in the two cases compare, in respect to being heavy or light, with other kinds of fabrics usually woven?

Ans. It is one of the heaviest kinds of goods that is made.

Int. 13. On what kind of loom, whether broad or narrow, were the operations which you thus witnessed?

Ans. A broad Thomas loom.

Int. 14. Did you see any operations on a narrow Thomas loom at the Arlington Mills, without the concentric portions in the slots in the sectors? If yea, when and how did the loom operate?

Ans. I did on the 30th August last. It operated well.

Int. 15. How did said narrow loom operate as compared with Thomas looms having the concentric portions in the slots in the sectors?

Ans. Equally as well, so far as I could see.

Int. 16. State whether or not you noticed any, and, if any, what, effect in the practical operation of the Thomas looms at the Washington Mills, when the friction brakes on the sectors got broken?

188 Ans. The harnesses settle to the centre or near the centre.

Int. 17. What, if any, effect does that have upon the shed?

Ans. The shed closes nearly, and the shuttle passes through in the wrong place, and spoils the goods.

Int. 18. In the practical operation of said Thomas looms which you have worked at the Washington Mills, state whether or not the rollers in the cam slots of the sectors run or drop into the concentric portions of the slots, and what you have observed in that respect.

Ans. In my room very few of the rollers drop into the concentric.

Int. 19. State whether or not, in the practical operation of said Thomas looms which you have worked at the Washington Mills, there is any difference in the successful operation of the looms in the two cases; that is, in the looms where the rollers do drop in the said concentric portions, and in the looms where they do not.

Ans. I think there is no difference.

Int. 20. State whether or not said concentric portions are of any use in the practical operation of said Thomas looms.

Ans. I think they are not.

Int. 21. State whether or not the friction of the friction brakes on the cam sectors in said Thomas looms is ever altered for the purpose of having the rollers in the cam slots of the sectors run into the concentric portions of the slots.

Ans. They are not.

Int. 22. State whether or not you witnessed any operations on the Marshall loom, so called, at the Arlington Mills; if yea, when, and state the result of those operations when the shoulders on the jacks became disengaged from the spring catches, and how said loom operated with the evener, and how it operated without the evener.

Ans. I did on the 30th August last. With the evener on, you could get a shed; without the evener, when the shoulders on the jacks became disengaged with the spring catches, there was nothing to hold the harnesses up, and they would drop, causing the shuttle to stop in the loom, which would stop the loom and endanger a break out of the warp.

Int. 23. Would a loom in which such result as that occurred be useful or otherwise for practical purposes?

Ans. It would not be useful; quite the contrary.

189 Int. 24. State whether or not the Marshall loom is or is not practically valuable for weaving purposes.

Ans. In my judgment it wouldn't be at all.

Int. 25. State how many of the Marshall looms you ever saw.

Ans. Only one, besides the model.

Int. 26. Where was that one?

Ans. The one I before referred to at the Arlington Mills, Lawrence.

Int. 27. Please state which of the two pattern chains, the one shown in Model A and that shown in Model B, is preferable, and why.

Ans. I think that in Model B is preferable to that in Model A, because you can make so many more changes in it, in the same time, than in making one in Model A.

Cross-examination by C. Browne, esq.:

Cross-int. 1. When you say that the Marshall loom is, in your judgment, not practically valuable for weaving purposes, do you judge from the operation of the loom you saw at the Arlington Mills?

Ans. I do from that and the models I have seen, this model A, and one I saw at the Arlington Mills.

Cross-int. 2. Have you ever examined the specification and drawings of the Marshall reissue patent?

Ans. I never have.

DANIEL H. KELLY.

Adjourned to Tuesday, 25th, at 10 a. m.

190 *Deposition of James C. Wing, taken, subscribed, and sworn to before N. Austin Parks, examiner.*

SEPT. 22, 1866.

Int. 1. State your name, age, residence, and occupation.

Ans. James C. Wing; age, 37 years; residence, Lawrence, Mass.; occupation, manufacturer.

Int. 2. State whether or not you are in the employment of any person or corporation, and, if so, what, and how long have you been so employed, and in what capacity. Please state your duties while so employed.

Ans. I am in the employ of the Everett Mills, Lawrence, Mass., and have been since two years last June, as overseer of weaving. I have charge of the weaving department, hiring the help, keeping account of their time and work, and a general oversight of the weaving department.

Int. 3. State whether or not you are a practical weaver; and, if so, how long has that been your business?

Ans. I am; and have been for fourteen years engaged in weaving.

Int. 4. Please state whether or not you have worked the Thomas fancy loom; and, if so, where and how long.

Ans. I have, at the Everett Mill in Lawrence, since two years last June.

Int. 5. How many of said looms have you operated, and how many of them are in operation in that mill?

Ans. Fifty, which is the number there.

Int. 6. Please state how, with reference to mechanical construction, said looms compare with Model B, so far as the mechanism is shown by said model.

Ans. The looms that I operate have a spring instead of a weight on the back of the jack. The lifting and depressing parts are operated by a crank instead of a scroll cam; that's all the difference I see.

Int. 7. Please state where said spring is, as compared with the position of the inner weight in Model B, and whether or not the spring is attached to the jack connected with it.

191 Ans. The inner weight is above the guiding-rack; the spring is immediately below it; the spring is not connected with the jack.

Int. 8. How have said fifty looms operated; successfully, or how otherwise?

Ans. Successfully.

Int. 9. Please state what satisfaction said looms have given in their practical operation.

(Objected to.)

Ans. Good satisfaction.

Int. 10. Please state whether or not you witnessed the operation of any Thomas looms at the Arlington Mills with the concentric portions in the slots in the sectors, and any operations on the same loom, or either of the same looms, without concentric portions in the slots; and what those operations were, and the results.

Ans. I did see them operate with the concentric portions, and without them. The result of the operation performed by the loom was weaving heavy beaver cloth. The shed was full and steady in both cases; no perceivable difference in the operation in the two cases.

Int. 11. When did you witness such operations; and, in respect to heaviness, how did the material worked compare with other classes of goods that are woven?

Ans. August 30th, 1866. The materiel was among the heaviest fabrics woven on fancy looms.

Int. 12. Have you noticed, in the practical operation of the said Thomas looms at the Everett Mill, about how often, or in what proportion of the looms, the rollers in the cam slots of the sectors run into the concentric portions of the slots? If you please, state what you have noticed in that particular.

Ans. Nearly all of them run into the concentric portions, so far as my observation extends, or nearly in.

Int. 13. Please state whether or not you have noticed any, and, if any, what, effect in the practical operation of said looms, when the friction brakes on the sectors get broken.

Ans. The tension of the yarn, when the shed is open, closes the shed, or draws it together, when the brake is broken.

Int. 14. What kind of goods have you made in said looms?

Ans. Cotton goods—8 ounces to the yard, about 30 inches in width.

192 Int. 15. How, in respect to being light or heavy, did or do the cotton goods woven on said looms compare with beaver cloth?

Ans. They are lighter—very much lighter, so far as the weight is concerned; so far as strain on the cam is concerned, not so much.

Int. 16. Please state whether or not you have witnessed any operations on the Marshall loom, so called, at the Arlington Mills; if so, when, and the result of the operations.

Ans. I have—on the 30th of August last. With the evener attached, a shed could be formed sufficient to allow the free passage of the shuttle through the shed. Without the evener attached, when the balls of the pattern chain forced the jack from the spring-catch, the shed closed upon the shuttle before it has cleared the warp.

Int. 17. State how many such Marshall looms you ever saw.

Ans. That was the only one.

Int. 18. State whether or not the Marshall loom is a practical loom for weaving purposes.

(Objected to.)

Ans. In my judgment, it is not.

Int. 19. State whether or not there is any practical difference in the operation of the Thomas looms where the rollers in the cam slots of the sectors run into the concentric portions of the slots, and where they do not.

(Objected to.)

Ans. None that I have observed.

Int. 20. Please state which of the two pattern chains, the one shown in Model A, and the one shown in Model B, is preferable, and why.

(Objected to.)

Ans. The one in Model B is preferable, because the operator can change from one pattern to another with more facility and in less time.

Int. 21. Please state at what places you worked at weaving before you commenced at the Everett Mills.

Ans. At Manchester, N. H., in the Amoskeag New Mills, and at Rockport Steam Mills, Rockport, Mass.

And in answer to cross-interrogatories by C. Browne, esq., deponent saith as follows:

Cross-int. 1. (De bene.) When you say that in your judgment
193 the Marshall loom is not a practical loom for weaving purposes, do you speak from your observation of the working of the so-called Marshall loom on the 30th August at the Arlington Mills?

Ans. Partly from that and partly from the general appearance of the loom and the models that I have seen.

Cross-int. 2. (De bene.) Did you ever examine the specification and drawings of the Marshall reissue patent?

Ans. I never have.

Cross-int. 3. (De bene.) What model of the Marshall loom have you seen beside Model A, now present?

Ans. I saw one at the Arlington Mills, beside the loom that I saw there.

Cross-int. 4. (De bene.) What do you see in the construction of Model A in addition to what you saw in the full-sized loom at the Arlington Mill, which makes you think that the Marshall loom is not a practical loom for weaving purposes?

Ans. Nothing in this that I did not see there, that I observe.

Cross-int. 5. (De bene.) Do you remember any differences between the model of the Marshall loom which you saw at the Arlington Mills, and the model of that loom now present and marked A?

Ans. So far as this Model A is complete, it is like that; I notice no difference.

Cross-int. 6. (De bene.) Did the model at the Arlington Mill have anything in it which Model A has not, except the shuttle motion, that you remember?

Ans. It might or might not have had patterns of the cloth and yarn beams; I don't remember, but so far as the harness motion is concerned, they are the same—the same in principle.

And in answer to direct examination resumed, deponent saith as follows:

Int. 22. State what effect in practical weaving the closing of the shed upon the shuttle, before it had cleared the warp, would have.

Ans. To stop the loom, ordinarily, and endanger the warp.

Int. 23. Would a loom in which this would occur be worth anything for weaving purposes?

194 Ans. In my judgment it would not, if that was the way the loom worked regularly.

Int. 24. Please state whether or not the concentric portions in the slots in the sectors in the Thomas looms are of any use in the practical operation of the looms.

(Objected to.)

Ans. So far as my experience extends, the loom will operate as well without as with them.

J. C. WING.

Deposition of Elisha Allen, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

SEPT. 25, 1866.

Int. 1. State your name, age, residence, and occupation.

Ans. My name is Elisha Allen; age, 46 years; residence, Winooski Falls, Vt.; occupation, weaver.

Int. 2. How long have you been engaged in the business of weaving, and at what places?

Ans. I commenced weaving, I think, in 1837—'37 or '38— and have been engaged in it ever since. I've worked at Winooski Falls all the time excepting two years at Utica, N. Y. I've worked in two mills at Winooski; the first was a satinet mill. I went into the one where I work now in 1839; it is called the Burlington Woollen Mills.

Int. 3. What are and have been your duties since you have been in the employment of the Burlington Woollen Mills?

Ans. Weaver. For a number of years I have been overseer of the weaving department in those mills.

Int. 4. Please state whether or not you are acquainted with Moses Marshall, who is now present; and, if yea, when you first became acquainted with him.

Ans. I am. I first became acquainted with him when he came to those mills to work, about 1843.

195 Int. 5. Please state whether or not said Marshall constructed and set up at said mills a loom; and, if yea, when or about what time it was; and how did said loom in respect to its mechanical construction compare with Model A, so far as the mechanism is shown in said model, for forming and shifting the shed?

Ans. He did; it's my impression somewhere in '48 or '49. I want to understand about that mechanism. The arrangement is very different; so far as arrangement is concerned it is. Both looms run with pattern chains, but the chains were quite different. In comparing Model A with the Marshall loom, I would say Mr. Marshall's chain was the same as in Model A. The jacks are the same as in Mr. Marshall's loom, so far as I can see; the evener to hold the shed is the same in the model and in his loom. The arrangement for driving it, I think, is something different, but accomplishes the same thing; the lifters for opening the shade are the same in the Marshall loom and in Model A. The catches for holding the jacks are the same; the rack for the jacks the same; the chains hold still in the same way; the chain is turned the same way, only it's my impression that the cog was turned in the opposite direction from that in the model, but that don't make any difference; I wouldn't say positive about this. I think the lower sets of jacks were two sets of elbows instead of these long jacks (putting his hand on what has been called in the case the lower heddle-levers). I believe I've gone all through with the making of it.

Int. 6. You say in your last answer that "the chains were quite different;" and in the same answer, that "Mr. Marshall's chain was the same as in Model A." Please explain your answer further in those particulars.

Ans. When I say quite different, I mean in the making and arrangement of the chains; I don't pretend to say but what they accomplish the same thing.

Int. 7. Please state in what particulars the making and arrangement of the chains was different.

Ans. This in Model A consists of bolts, trucks, tubes, and links, and things to hold the links. It is a Crompton chain, and the same that Mr. Marshall used on his loom; when I spoke of the chain as different, I was comparing Model A with Model B.

196 Int. 8. How were the outer parts of the upper heddle-levers, and the outer ends of the lower heddle-levers, in the loom so constructed and set up by said Marshall, connected with the jacks, as compared with the way in which they are connected in said Model A?

Ans. I think Mr. Marshall's riveted one one side instead of going through—I speak of the upper heddle-levers. The lower heddle-levers connect with the jacks; the same in Marshall's and in Model A.

Int. 9. Please explain what you mean by your language, in answer to 5th interrogatory, when you say "the arrangement is very different, so far as arrangement is concerned."

Ans. That wasn't the way I understood it; I had got the idea that you were speaking of the loom Model B. The arrangement of this loom A and the Marshall loom is the same.

Int. 10. Please state whether or not said Marshall was in the employment of the said Burlington Mills at the time he constructed and set up the loom which you have spoken of as having been constructed and set up by him there.

Ans. He was.

Int. 11. State what you had to do, if anything, with the operation of said loom so constructed and set up by said Marshall.

Ans. I had to start it; I put one warp into it, and wove some cloth on it—my impression is from one to two cuts—then the warp was taken out.

Int. 12. How many yards did a cut constitute?

Ans. I think our cuts was about 25 yards then.

Int. 13. Was said Marshall present during any part of the time that you operated the loom so constructed and set up by him?

Ans. Yes, sir, I believe he was.

Int. 14. About how frequently was he so present?

Ans. I couldn't say how frequently he was there. All I can remember is that he was at work in the shop, and used to come up and see the loom. He used to come up into the weave-room frequently, and that is the most I can say.

Int. 15. State whether or not he and you had conversation in regard to that loom when it was in operation, and whether or not this was frequently, or how otherwise.

197 Ans. I've no doubt but what we did at the time; but whether it was frequent or otherwise, I couldn't say.

Int. 16. State whether or not said Marshall had or not all opportunity and facilities to make the loom run well, if it could be made to run well.

(Objected to as leading.)

Ans. He did, as far as I can recollect.

Int. 17. State why the warp was taken out of that loom as you have stated.

Ans. Well, as near as I can recollect, it was taken out because we could weave it better in our other looms.

Int. 18. What became of said Marshall loom?

Ans. It was changed into the original loom it was started on. That is, to the same that it was when he took it. He took a Crompton loom and altered it, if I recollect right, and it was changed back.

Int. 19. How was said Marshall loom for the purposes of practical weaving, as compared with the other looms in the mill; an improvement or not?

Ans. Well, I think it was not, so far as I can recollect.

Int. 20. State whether or not it was a successful loom or a failure.

(Objected to as leading.)

Ans. It was not successful with us.

Int. 21. State whether or not you ever saw any Marshall loom except the one that you have mentioned.

Ans. I have not except this Model A.

Int. 22. Was there more than one warp put into said Marshall loom?

Ans. No, sir.

Int. 23. Do you know where said Marshall went after leaving the Burlington Mills?

Ans. No; I think he went to Lowell, but I don't know certain.

Int. 24. State whether or not you have ever operated the Thomas fancy loom; if yea, when, where, for about how long, and how many.

Ans. I have. I think I commenced on them about 1863, at the Bur-

lington Mills, and have operated them ever since. We are running fifty-two now.

Int. 25. How do they operate?

198 Ans. Well.

Int. 26. State what kind of fabrics you weave on them?

Ans. I've wove all kinds that has been called for; we are principally on Moscows now. Some call 'em Moscow beavers.

Int. 27. Have you noticed, in the operation of said Thomas looms, any, and, if any, what effect when the friction brakes on the sectors get broken?

Ans. It loosens the harness so it drops.

Int. 28. What effect does it have on the shed?

Ans. Well, the shed and the harness are the same thing; when the harness drops the shed closes.

Int. 29. State whether or not the friction on the friction brakes is ever altered for the purpose of making the rollers in the slots in the cams in the sectors run into the concentric portions of the slots.

Ans. No; we don't depend on anything but the friction to keep it in its place.

Int. 30. State whether or not, in the practical operation of said Thomas looms, said rollers do run into the concentric portions of the slots.

Ans. I always set 'em to get the amount of shed that I want, without any regard to where the rollers come. The rollers will stay as well in one place as another, so far as weaving is concerned.

Int. 31. State whether or not the concentric portions in the slots are or are not of any use.

(Objected to.)

Ans. Nothing more than to get room to get the roll in.

Int. 32. Suppose the slot was of the same length, and without any concentric portions, how would the loom work, compared with the slot having concentric portions?

(Objected to.)

Ans. It wouldn't make any difference.

Int. 33. State whether or not there is any difference in the practical operation of the loom in the case where the rollers go into the concentric portions, and the case where they do not.

Ans. No, sir; not that I know of.

Int. 34. If the slots in the sectors are of the same length, does it make any difference in the practical operation of the loom whether the ends are concentric or not?

(Objected to.)

Ans. I think not.

199 Int. 35. What are the relative merits of the pattern chain in the Marshall loom and the pattern chain in the Thomas loom?

Ans. The Thomas chain is built a good deal easier and quicker than the other; by built, I mean set for a new pattern.

Int. 36. State about how the length of time, in setting the same pattern by the same man on the two chains, compares.

Ans. I have never tried it, but should judge a man could set five or six of the Thomas chains to one of the other chain.

Int. 37. Referring to your answer to the 31st interrogatory, state whether or not, if the slots in the sectors were of the same length, without having any concentric portions, the loom would work as well, or how otherwise, as if there were concentric portions.

(Objected to.)

Ans. I think they would work as well.

Int. 38. State how the Thomas looms which you have operated, in their mechanical construction, compare with Model B, so far as the mechanism is shown in said model.

Ans. It is the same.

Int. 39. Do said Thomas looms that you have operated contain the inner weighted levers which operate on the jacks, as shown in Model B?

Ans. Yes, sir.

Int. 40. State whether or not you misapprehended the 5th interrogatory, and were proceeding to compare Model A with Model B, and stopped in your comparison when you discovered that you had misapprehended the question.

Ans. Yes, sir.

And in answer to cross-interrogatories by C. Browne, esq., deponent saith as follows, viz:

Cross-int. 1. Are you not now employed by the Washington Mills of Lawrence?

Ans. No, sir.

Cross-int. 2. Is not the Burlington Woollen Mills connected in business with the Washington Mills at Lawrence?

200 Ans. I don't know but there is men that own stock in both mills. I don't know for certain as to that.

Cross-int. 3. Do you not remember any difference between the Marshall loom which was set up and run at the Burlington Mills somewhere in '48 or '49, as you say, and the loom represented by Model A?

Ans. No, sir, I don't. I should say that was the same thing.

Cross-int. 4. Please reflect carefully, and say whether you are prepared to swear, as a matter of recollection, that there were any horizontal upper and lower heddle-levers in that loom, such as are shown in Model A.

Ans. My impression is the lower ones worked on knees.

Cross-int. 5. What do you mean by knees? Can you describe from recollection how the machine was constructed in respect to that part of it, or can you not?

Ans. I can. My impression is there was a knee or an elbow that went on this lower bearing that goes through the heddle-levers, and one part of the elbow run out and was attached to the wires connected with the lower ends of the jacks; then the other end of the elbow was connected to another wire that run out and connected to another elbow in the centre of the loom. The other end of that elbow was attached to the harness by wires and straps.

Cross-int. 6. Was the arrangement of both the upper and lower series of heddle-levers the same in this respect?

Ans. I don't recollect whether there was elbows on the top, or whether they was just the same.

Cross-int. 7. Do you remember whether or not there was any other difference in construction in that loom and Model A?

Ans. I don't see any.

Cross-int. 8. Of what material were the connections between the two sets of knees, or bent levers, you have described, and the connections between the outer set and the lower end of the jacks, and the connections between the inner set and the leaves of heddles?

Ans. Of wire.

Cross-int. 9. Was the old Crompton loom on which Mr. Marshall's harness motion was placed, making the Marshall loom which you have described, a broad or a narrow loom?

201 Ans. A broad loom.

Cross-int. 10. In what capacity was Mr. Marshall employed at the Burlington Mills, when this loom was set up?

Ans. As head machinist.

Cross-int. 11. In what capacity were you then employed in that mill?

Ans. Weaver.

Cross int. 12. Did you know a Mr. Austin who was at that time employed in that mill?

Ans. Yes, sir.

Cross-int. 13. Is he dead?

Ans. I understood he was.

Cross-int. 14. In what capacity was he employed in that mill at the ime this loom was set up?

Ans. He was a weaver.

Cross-int. 15. Which of you had charge of putting in the warp and operating the loom, in the first instance?

Ans. I had. Mr. Austin didn't work in that room.

Cross-int. 16. Did not Mr. Austin have something to do with the setting up and starting of that loom?

Ans. I've no recollection of his having anything to do with the starting of it. Mr. Marshall set up the loom.

Cross-int. 17. Did Mr. Austin have nothing to do with the working of it at all, first or last?

Ans. I've no recollection that he did.

Cross-int. 18. Did the Burlington Mills fail in the same year in which this Marshall loom was started?

Ans. I don't recollect whether it was that year, or the year before, or year after.

Cross-int. 19. Are you able to say how long it was from the starting of the Marshall loom to the time it was changed back, as you say, to the same that it was when he took it?

Ans. No, sir; I am not.

Cross-int. 20. Was it not more than a year?

Ans. I couldn't say how long it was. I don't recollect.

Cross int. 21. Was that Marshall loom under your charge while it stood in the mill?

202 Ans. I had charge of that room that the loom was in.

Cross-int. 22. Are you prepared to swear that not more than two cuts of about twenty-five yards each was woven upon it?

Ans. I think that was the extent that was wove on it.

Cross-int. 23. You do not recollect, do you, why the Marshall loom was, as you say it was, unsuccessful?

Ans. I recollect that we took the warp and put it in the other looms, because we could weave it better in them than we could in that.

Cross-int. 24. Question 23d repeated.

Ans. I don't know as I could give any other answer than I have, there was so many different points to it.

Cross-int. 25. Did you tell Mr. Moses Marshall last week at Winooski that you did not recollect the reason why the loom was not successful?

Ans. We had conversation last week. I might have said something to that effect. That's about the same answer that I gave before.

Cross-int. 26. Can you name any one else besides yourself and Mr. Marshall that had anything to do with, or had any knowledge of, the running of that Marshall loom at any time from its starting to its being altered back again?

Ans. Yes, sir, I can.

Cross-int. 27. Please do so.

Ans. Ira Allen. I don't know of any other.

Cross-int. 28. Is Ira Allen your brother?

Ans. Yes, sir.

Cross-int 29. Where does he now live, and how is he employed?

Ans. He lives at the same place that I do. He carries on a foundry.

Cross-int. 30. Is your recollection of the construction of the Marshall loom, as used at the Burlington Mills, so indistinct that you are unable to say whether the connection of the jacks with the tops of the leaves of heddles was through knees or bent levers, as in the case of the lower part of the loom, or how it was?

203 Ans. Well, it was my impression that they was knees. I can't say positive.

And in answer to direct examination resumed, deponent saith:

Int. 41. At the time when you had conversation with said Marshall last week, did he come to see you, or did you go to see him, and at what place did the conversation occur?

Ans. He called on me at the woollen mill in Winooski, and the conversation occurred there.

Int. 42. Can you state about how many cuts the warp had in it that was put into the Marshall loom?

Ans. We put on six cuts to a warp at that time. It was a regular warp.

ELISHA ALLEN.

Adjourned to Friday, 28th, at 10 a. m.

Deposition of Leonard Peirce, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

SEPT. 28, 1866.

Int. 1. State your name, age, residence, and occupation.

Ans. Leonard Pierce; age, 59 years; residence, Lowell, Mass.; occupation, manufacturer. I have been a weaver at least thirty years.

Int. 2. State whether or not you have ever been in the employment of the Middlesex Mills at said Lowell; if yea, from what time to what time, and in what capacity?

Ans. I have, from January, 1840, to the present time. I have been engaged all the time in weaving—for about four years overseer, the rest of the time as second hand; that is, at various times I have been overseer, amounting in all to about four years.

204 Int. 3. Please state generally what have been your duties as second hand and as overseer.

Ans. As overseer, I had the general charge of the weaving department of one room. As second hand, my duties were more especially to look after the mechanism of the looms and direct how they should be adjusted.

Int. 4. State whether or not you are acquainted with Moses Marshall, who is now present; and, if yea, when and where you became acquainted with him.

Ans. I am slightly acquainted with him. I first became acquainted with him, I should say, in '49 at the Middlesex Corporation in Lowell.

Int. 5. State what he was doing at said Middlesex Mills.

Ans. He was endeavoring to start a loom.

Int. 6. When or about what time did he endeavor to start it, and did you or not work in the room when he endeavored to start it?

Ans. It was somewhere between '48 and '51. I worked in the room.

Int. 7. State what year it was, as nearly as you can now fix it.

Ans. 1849.

Int. 8. How did said loom, which said Marshall endeavored to start, compare in its mechanical construction with the mechanism represented in Model A, so far as the mechanism is there represented?

Ans. Exactly, so far as I can see.

Int. 9. Please state about how long said Marshall was engaged on said loom, and whether or not he attempted to run it, and also who constructed it, and how it operated.

Ans. I should say he was engaged on it ten days at least. He attempted to run it with the help of a girl to tend it. I do not know who constructed it. It operated badly.

Int. 10. Who had charge of said loom, and what facilities did said Marshall have for making it successful, if it could be made so?

Ans. Mr. Marshall himself had charge of it. He had all necessary facilities for making it successful.

Int. 11. State how, in respect to utility for weaving purposes, said loom compared with other looms then in existence.

Ans. I hardly know how to answer the question. The loom would scarcely weave at all.

205 Int. 12. State whether or not said loom was practically valuable for weaving purposes.

(Objected to.)

Ans. It was a perfect failure, so far as the trial there was concerned.

Int. 13. Was it ever used, after said Marshall ceased to use it, in the Middlesex Mills?

Ans. No; it never was.

Int. 14. What did you notice in the operation of that loom at the Middlesex Mills, if anything, in respect to its ability for practical weaving?

Ans. That it would not weave the cloth right, what little it did weave.

Int. 15. What difficulties, if any, were there in that respect?

Ans. It made what we call wrong shades or false picks. It would likewise let the warp come together, and consequently the shuttle would break it very badly.

Int. 16. How was the loom with respect to breaking?

Ans. It frequently broke.

Int. 17. What parts of it do you recollect breaking?

Ans. I've no recollection of any particular parts, but it was the mechanism that Mr. Marshall applied himself. I've no recollection of any other parts breaking. I recollect the leveller (the evener) breaking, from coming in contact with the levers (the heddle-levers).

Int. 18. How many of said Marshall looms have you ever seen? By Marshall looms I mean the same kind as he endeavored to start at the Middlesex Mills.

Ans. That one, and one which appeared to be a fac-simile of it at the Arlington Mills, at Lawrence, which I saw on the 29th of August last.

Int. 19. How did the one operate that you saw at the Arlington Mills?

Ans. Like the one I saw at Lowell. It didn't operate at all.

Int. 20. What effect did the removal of the evener have in the operation of the one you saw at the Arlington Mills?

Ans. It made it go very much worse, if possible. It would then allow the warp to fall together every revolution, and the shuttle would not go through at all.

206 Int. 21. Please state whether or not, before you saw said Marshall loom at the Middlesex Mills, there was at said mills any open-shed fancy loom; and, if yea, can you produce a model of it, and state when it was at said mills, and how many of said looms there were there, and about how long they were used; and what, if anything, you had to do with such looms.

Ans. There was; like model "Defendant's Exhibit 5," which I produce. They were at the Middlesex Mills some time between 1840 and 1844; to the best of my recollection they were used about four months. There were eight of them. I helped to start them up, and then to take care of them after they were started.

Int. 22. How did said eight looms, in their mechanical construction, compare with the mechanism shown in Model 5, so far as the mechanism is shown in said model?

Ans. They were substantially the same, and nearly a fac-simile of this so far as relates to the motion of harnesses. They were almost exactly the same, so far as I can see, in all respects so far as the model shows.

Int. 23. State whether or not there was any, and, if any, what difference in mechanical construction between said eight looms and said Model 5, so far as the mechanism is shown in that model, for forming and shifting the shed.

Ans. The segments that give motion to the harness are fastened on differently in the model from what they were in the original looms, but the working surface is precisely the same. I see no other difference, only in point of size. They give precisely the same motion to the harnesses.

Int. 24. How are the working surfaces of the forms of the segments in said Model 5 as compared with those of the segments used in said eight looms?

Ans. Precisely the same.

Int. 25. What was the difference in the fastening that you have referred to?

Ans. These in the model were screwed on; a screw through each one of the segments. In the original looms they were not screwed on, and I cannot say exactly how they were put on.

207 Int. 26. Please state why, or for what purpose, said eight looms were introduced into said Middlesex Mills.

(Objected to.)

Ans. To weave up some very tender yarn that they had on hand, which they could not weave with any other loom that they then had.

Int. 27. On what kind of work were said eight looms used?

Ans. Eight-shed doeskin.

Int. 28. State how much of the tender yarn, that you have referred to, was woven on said eight looms.

Ans. All they had on hand, but how much I cannot state.

Int. 29. How did said eight looms operate with reference to success or otherwise?

Ans. They operated successfully.

Int. 30. How did said eight looms operate, as compared with the operation of the close-shed fancy looms?

Ans. They operated very much better.

Int. 31. In what respect or respects?

Ans. You could weave the cloth much heavier without breaking the warp.

Int. 32. In the practical operation of said eight looms, during how

many successive picks of the shuttle could the same heddle remain up or down?

Ans. Seven.

Int. 33. In the practical operation of said eight looms, how did the heddles move from their extreme elevated to their extreme depressed position and vice versa, whether with or without stopping?

Ans. They went to one extreme from the other without stopping.

Int. 34. How many varieties of pattern could be produced by the pattern mechanism that was used in said eight looms?

Ans. The number is beyond the comprehension of man, providing you have a full set of segments.

Int. 35. State whether or not said eight looms had the same or a different number of segments from that shown in said Model 5.

Ans. The same number.

Int. 36. State, as nearly as you can, about how many yards were woven on said eight looms.

Ans. I've no means of knowing anything about it, and at this distant day I cannot tell.

208 Int. 37. State whether or not the number of yards which were woven on said eight looms would amount or not to a hundred or a thousand yards.

Ans. I have no doubt it amounted to a good many thousands; I have no means of telling.

Int. 38. In what room did you work at said Middlesex Mills when said eight looms were in operation there?

Ans. In the same room where them looms were.

Int. 39. State what, if anything, you had to do with said eight looms.

Ans. I helped put the warps in, and helped adjust them, when they needed adjustment.

Int. 40. How frequently did you witness, and how familiar were you with, the operation of these eight looms?

Ans. I was there with them all the time, and was perfectly familiar with their operation.

Int. 41. How are you enabled to fix the time as being between 1840 and 1844 that said eight looms were at the Middlesex Mills?

Ans. I commenced in January, 1840, and worked not quite four years in that room, and it was during that time that they were put in operation; I left them there when I left that room, but idle.

Int. 42. Who made said Model 5; and state whether or not any directions were given as to the construction of the same; and, if so, by whom were such directions given, and to whom?

Ans. I do not know who made it; I gave the instructions to Mr. Thomas.

Int. 43. What instructions did you give him? And state whether or not said model was constructed in conformity with your directions or how otherwise.

Ans. I gave him a wooden pattern of one of those plates with the segments on it, all of wood, and I instructed him with regard to the jack levers and heddle levers. It was constructed in conformity to my directions.

And in answer to cross-interrogatories propounded by Causten Browne, esq., of counsel for complainant, deponent saith:

Cross-int. 1. From January, 1840, to the present time, have you been employed in the mill of the Middlesex Co., at Lowell?

209 Ans. In the mills most all the time. I've been out occasionally on account of sickness, or to rest, during that time.

Cross-int. 2. When the Marshall loom was run, or, as you say, attempted to be run, at the Middlesex Mills, in what capacity were you employed there?

Ans. As second hand in the weave-room where that loom was.

Cross-int. 3. Who was overseer in that room?

Ans. John Harding.

Cross-int. 4. Did he have anything to do with the setting up or running of this Marshall loom?

Ans. He did not, other than to order the warp that was put into it.

Cross-int. 5. Did he see its operation from time to time while it was running?

Ans. He did.

Cross-int. 6. Was not the loom in fact operated under his charge or direction?

Ans. He gave no directions about it to my knowledge, only the warp that was to be put into it, and the girl that was to be put on to the loom.

Cross-int. 7. Who was the girl?

Ans. I've forgotten.

Cross-int. 8. Did Mr. Harding direct you to do what you did about the loom?

Ans. He directed me about warp to put into it, and that was all.

Cross-int. 9. Was that a broad loom or a narrow loom?

Ans. A narrow loom.

Cross-int. 10. Are you willing to say that Mr. Marshall was present one-half of the time during which this loom was operated, or attempted to be operated, as you have described?

Ans. I should say he was just about that; just about half the time he stood over it, or was at work on it there, or in the shop.

Cross-int. 11. This loom was an old loom-frame with Marshall's harness motion applied, was it not?

Ans. It was.

Cross-int. 12. What sort of loom was it before it was so altered?

210 Ans. I cannot say certain; my impression is it was just the same as the looms we had in the Middlesex.

Cross-int. 13. What sort of looms were they?

Ans. They were originally narrow cassimere looms altered to doeskins, but I don't know as this one was ever altered.

Cross-int. 14. Whether it was cassimere or doeskin, by what name was it known?

Ans. I knew them by no other names than cassimere looms, or doeskin looms.

Cross-int. 15. Was it an old Crompton loom?

Ans. I don't know, sir, what it was.

Cross-int. 16. Do you remember distinctly about the character and condition of the frame of that loom, so that you can describe it now?

Ans. I saw nothing peculiar about it by which I can describe it now.

Cross-int. 17. Have you seen that Marshall loom, or any part of it, since it was so operated, as you described, at the Middlesex Mills?

Ans. I have not.

Cross-int. 18. Was Mr. Samuel T. Thomas at that time employed by, or doing any work for, the Middlesex Mills?

Ans. I should say that about that time they got him to strike a set of patterns for doeskin cams. I am by no means certain that it was at that time though.

Cross-int. 19. How long were you present on the 29th of August last, examining the Marshall loom and witnessing its operation at the Arlington Mills?

Ans. I think a good part of three days previous to the 29th; most all day on the 29th; not after.

Cross-int. 20. You say that the eight cam-looms like deponent's Exhibit 5 operated very much better than the close-shed fancy looms. Do you mean by "close-shed fancy looms," looms having a pattern chain and jacks?

Ans. Those are the only close-shed fancy looms I ever saw.

211 And in answer to direct examination resumed, deponent saith:

Int. 44. Did the close-shed fancy looms that you have referred to have or have not a lifter and depresser?

Ans. They did.

Int. 45. State whether or not the lifter lifted, and the depresser depressed, the jacks in the operation of these close-shed fancy looms.

Ans. They did.

Int. 46. State whether or not you have seen Mr. Harding (to whom you have referred in your cross-examination) to-day, in consultation with Mr. Moses Marshall.

Ans. I have.

L. PIERCE.

Deposition of Albert Marshall, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

Int. 1. State your name, age, residence, and occupation.

Ans. Albert Marshall; 56 years of age; residence, Methuen, Mass.; occupation, farmer, at this time.

Int. 2. Were you ever in the employment of the Middlesex Mills of Lowell, Mass.; if yea, from what time to what time, and in what capacity?

Ans. I was; from about '38 to '47. I know '47 is correct, and '38 I think is right. I was a machinist.

Int. 3. State whether or not during the time that you were so in the employment of the Middlesex Mills there was in operation there any open-shed fancy looms; and if yea, whether or not you had anything to do with them and what; and state about how long before you left the employment of said mills they were first operated there.

Ans. There were; I done a good deal of work in fitting them and putting them together. I can't tell how long before I left they were put in operation.

Int. 4. State about how long, as nearly as you can.

212 Ans. I should think it might be three or four years; I think the last part of my time there; I don't seem to recollect.

Int. 5. State whether or not you have examined model Exhibit No. 5.

Ans. I have.

Int. 6. State how said open-shed fancy looms that you have spoken of compared in their mechanical construction with said model, so far as concerns the mechanism represented by said model.

Ans. They are precisely the same thing, I should judge.

Int. 7. State about how long said open-shed fancy looms were in operation in said Middlesex Mills.

Ans. I couldn't tell, as I was not a weaver. I should think some number of months.

Int. 8. Do you recollect what kind of fabric they wove on them?

Ans. Doeskin, I believe.

ALBERT MARSHALL.

Counsel for complainant declines to cross-examine.

Adjourned to 29th, 10 a. m.

Deposition of Edward S. Renwick, taken, subscribed, and sworn to before N. Austin Parks, examiner.

OCT. 1, 1866.

Int. 1. Please state if you have previously given a deposition in this case.

Ans. I have.

Int. 2. State whether or not you have examined the exhibit marked "Defendent's Model, Exhibit No. 5," and whether or not you understand the operation of the mechanism thereby represented.

Ans. I have examined the exhibit referred to, and believe that I understand the operation of the mechanism thereby represented.

Int. 3. To what class of looms does it belong?

(Objected to.)

213 Ans. To the class of open-shed fancy looms.

Int. 4. State whether or not it contains any combination of mechanism for forming and shifting the shed; and, if yea, state generally what that combination is.

Ans. It does; that combination consists generally of leaves of heddles; of connecting mechanism, consisting of upper and lower series of heddle levers and rods for connecting the heddles with jacks; of jacks that operate the leaves of heddles; of elevators and depressers for operating the jacks; of pattern mechanism; and of holding mechanism for holding the jacks in their elevated or depressed positions when not required to be operated.

Int. 4. State generally the operation of this combination of mechanism in said model.

Ans. The general mode of operation is that the pattern mechanism selects the jacks; that the jacks are then either elevated or depressed by the elevators and depressers carrying the heddles with them, and thus forming the shed; and that all the jacks and consequently the leaves of heddles are then held held fast in their elevated or depressed positions by means of the holding mechanism, thus holding the shed open until the pattern required leaves of heddles to move from the elevated to the depressed position or vice versa. Such leaves as the pattern may then require to be moved are again selected by the pattern mechanism, and by means of the mechanism above described are shifted from the highest to the lowest position or vice versa, and when thus shifted are again locked or held fast as before stated. The general mode of operation is further, that the leaves of heddles are selected, are moved from their extreme elevated to their extreme depressed position or vice versa, and are held in such positions until the pattern requires their positions to be changed by pattern mechanism, elevators and depressers, and holding mechanism, all acting upon and through jacks.

Int. 5. State how the result effected by this combination in model Defendent No. 5 compares with the result effected by the combination of jacks, pattern mechanism, lifters and depressers, and holding mechanism in the loom described in the Marshall reissue patent, and represented by complainant's Model A.

Ans. The result accomplished is identically the same; but the
214 mechanism of said Model 5 accomplishes the result with absolute certainty, while the mechanism of loom described in said Marshall reissue patent and represented in Model A does not accomplish the result with certainty.

Int. 6. In loom represented by Model No. 5, what, if anything, does the pattern mechanism act in conjunction with, to select the figure?

Ans. It acts in conjunction with the jacks.

Int. 7. What, if anything, in Model No. 5, does the lifting and depressing mechanism act upon, and for what purpose?

Ans. It acts upon the jacks for the purpose of moving them from their extreme elevated to their extreme depressed positions and vice versa, and through them the leaves of heddles.

Int. 8. What, if anything, in said Model No. 5, does the holding mechanism act upon, and what is its purpose?

Ans. The holding mechanism acts upon the jacks for the purpose of holding them in their extreme elevated and depressed positions and through them the leaves of heddles.

Int. 9. State what, if anything, in the said Model No. 5, do the jacks therein act in conjunction with, and for what purpose.

Ans. They act in conjunction with the pattern mechanism, the elevators and depressers, and the holding mechanism, and through the connecting mechanism with the leaves of heddles, for the purpose of transmitting to the leaves of heddles the operations of the pattern mechanism for selecting them; of the elevators and depressers for moving them from their extreme elevated to their extreme depressed positions and vice versa; and of the holding mechanism for holding them in their extreme positions until the pattern requires them to be moved.

Int. 10. State what constitute the jacks, the lifters and depressers, pattern mechanism, and the holding mechanism in said Model No. 5.

Ans. In that model the series of reciprocating bars, which are moved alternately up and down, are connected by rods with the upper and lower series of heddle levers, and vibrate upon the fixed stud projecting at the side of the loom-frame, constitute the jacks. The inclined
215 surfaces of the cams at the side of the loom, which act upon the jacks above described to lift them and depress them, are the elevators and depressers. The series of cam segments secured to the discs at the side of the loom constitute the pattern mechanism, the said segments being arranged on the several discs so as to produce the pattern required. The concentric surfaces of the cam segments are the holding mechanism for holding the jacks in their raised and depressed positions.

Int. 11. State whether or not the pattern mechanism in said Model No. 5 is or not variable; and, if yea, how the same can be varied.

Ans. It is variable. It may be varied to change the pattern woven, by changing the cam segments.

Int. 12. State during how many consecutive picks of the shuttle the heddles in Model No. 5 can be held in their extreme elevated and extreme depressed positions in said model.

Ans. During six as the pattern mechanism is now set, but by changing the cam segments or the pattern mechanism the heddles may be kept in their extreme positions during seven consecutive picks.

Int. 13. State whether or not the combination in said Model No. 5 of the jacks that operate the leaves of heddles, the lifters and depressers, the pattern mechanism for determining the pattern, and the mechanism for holding the jacks either in their elevated or depressed positions when not required to be operated, is or is not substantially the same as the combination of jacks, lifter and depresser, pattern mechanism, and holding mechanism set forth in said Marshall reissue patent.

Ans. Whether it is or is not depends upon the construction that is put upon the language in which the combination is set forth in said patent. If the language be construed so broadly as to include any combination of jacks that operate leaves of heddles, lifters and depressers

for moving said jacks from their extreme elevated to their extreme depressed positions and vice versa, pattern mechanism for determining the pattern, and mechanism for holding the jacks either in their elevated or depressed positions when not required to be operated, which combination has the general mode of operation recited in my answer to
216 the 4th interrogatory in this present deposition, then the combination in said Model 5 is substantially the same as the combination inquired of as set forth in said Marshall reissue patent. But if the language be construed so as to confine the combination of the jacks that operate the leaves of heddles, the lifter and depresser, the pattern mechanism for determining the pattern, and the mechanism for holding the jacks either in their elevated or depressed positions when not required to be operated, to one in which each of the said four members operate substantially in the specific manner of those represented in the drawing of the patent, then the combination in said Model 5 referred to is not substantially the same as the said combination in said Marshall reissue patent.

Int. 14. State whether or not you find in said Model No. 5 any, and, if any, what mechanism which accomplishes the result accomplished by the evener in the loom represented by complainant's Model A.

Ans. I do. One of the results accomplished by the evener in Model A is the holding of the jacks and heddles in their elevated and depressed positions during a portion of the time that they are to be so held in the operation of the loom. That result is accomplished in Model 5 by the portions of the concentric surfaces of the cam segments. The other result accomplished by the evener in Model A is the control of the heddles preventing them from being moved prematurely or in advance of the action of the lifters and depressers to their mean positions by the tension of the warp threads, and thereby preventing the warp threads from closing upon the shuttle. That result of the evener is accomplished in Model 5 by the rearmost inclines of the inner and outer cam segments operating upon the wheels projecting from the sides of the jacks. By the rearmost inclines I mean those which came last to the wheels of the jacks in the movement of the cam segments, those inclines of the inner and outer cam segments which come first to the wheels of the jacks in the movement of the cam segments being the lifters and depressers in Model No. 5.

E. S. RENWICK.

(Counsel for complainant declines to cross-examine.)

217 *Deposition of F. C. Treadwell, jr.— recalled — taken, subscribed, and sworn to before N. Austin Parks, examiner.*

OCT. 2, 1866.

Int. 1. State whether or not you have previously testified in this case.

Ans. I have.

Int. 2. State whether or not you have examined the model marked No. 5, and whether or not you understand the operation of the mechanism thereby represented.

Ans. I have examined said model, and believe I understand the construction and operation of the mechanism represented by it.

Int. 3. What kind of loom is it?

Ans. The model represents mechanism for forming and shifting the sheds of an open-shed fancy loom.

Int. 4. State whether or not said Model No. 5 contains any and, if any, what combination of mechanism for forming and shifting the shed.

Ans. It does. The combination is of leaves of heddles, connecting mechanism connecting them with jacks, the connecting mechanism being upper and lower heddle levers and connecting rods, jacks, lifters and depressers. a pattern mechanism, and a holding mechanism.

Int. 5. Please state generally the operation of this combination of mechanism in Model 5 for forming and shifting the shed.

Ans. The general operation is that the pattern mechanism determines the pattern by selecting the jacks to be moved; that the jacks are then either elevated or depressed by the lifters or depressers (which act upon projections from the jacks), carrying the respective heddles with them from a completely elevated to a completely depressed position, or vice versa, thus forming the shed; and that all the jacks, and consequently the leaves of heddles, are then held fast in their elevated and depressed positions by means of the holding mechanism, thus holding the shed open until the pattern requires the leaves of heddles to move
218 from their elevated to their depressed positions, and vice versa. Such of the leaves of heddles as the pattern may then require to be moved up or down are again selected by the pattern mechanism, and, by means of the lifters and depressers, are shifted from their highest to their lowest position and vice versa, and, when thus shifted, are again held or locked fast by the holding mechanism as before stated. The general operation is also that the leaves of heddles are selected and moved up and down from their highest to their lowest positions, or vice versa, and locked or held fast in their highest or lowest positions during successive picks, or as long as the exigencies of the pattern require, by means of a pattern mechanism, lifters and depressers, and a holding mechanism, all operating upon and through the jacks for that purpose.

Int. 6. State how the result effected by this combination in Model No. 5 compares with or differs from the result effected by the combination of jacks, pattern mechanism, lifter and depresser, and holding mechanism, in the loom described in the Marshall reissue patent, and represented by complainant's Model A.

Ans. The result is the same, viz., that the leaves of heddles are moved at once from their highest to their lowest position, or vice versa, as the exigencies of the pattern may require, and locked or held fast in such position until the exigencies of the pattern require them to be moved. In the loom represented by Model 5 this result is certain; but, in the loom described in the Marshall reissue and represented by Model A, it is uncertain.

Int. 7. In loom represented by Model No. 5, does the pattern mechanism act in conjunction with anything and, if so, what, to select the figures?

Ans. It does. It acts in conjunction with the jacks.

Int. 8. In loom represented by Model 5, does the lifting and depressing mechanism act upon anything; and, if so, upon what, and for what purpose?

Ans. Yes. The lifters and depressers act upon the jacks for the purpose of elevating them and depressing them from their highest to their lowest positions, and vice versa, consequently elevating and depressing the heddles from their lowest to their highest positions, and vice versa.

219 Int. 9. In said Model 5, does the holding mechanism act upon anything; and, if so, upon what, and what is its purpose?

Ans. It does. It acts upon the jacks for the purpose of holding them fast, and consequently the heddles, when in their extreme elevated and depressed positions, until the exigencies of the pattern require them to be shifted.

Int. 10. State whether or not the jacks in said Model 5 act in conjunction with anything; and, if so, in conjunction with what, and for what purpose.

Ans. They do. They act in conjunction with the leaves of heddles and connecting mechanism connecting them therewith, on the one hand, and with the pattern mechanism, the lifters and depressers, and the holding mechanism, on the other, for the purpose of shifting the sheds and holding them, when shifted, during successive picks, or until the exigencies of the pattern require the sheds to be shifted.

Int. 11. State what constitutes the jacks, the litters and depressers, pattern mechanism, and the holding mechanism in said Model 5.

Ans. The jacks are the horizontal metal bars connected with the upper and lower heddle levers, and moved up and down at the side of the loom, being pivoted at one end upon a stud projecting from the side of the loom, and having a projecting pin or roller on the side of each of them for the lifters and depressers to act upon in lifting and depressing them. The lifters and depressers are inclined portions of the segments upon the circular metal discs at the side of the loom, which inclined portions act as rotating cams to lift the jacks by the rotation of the circular discs. The pattern mechanism consists of the arrangement of the series of segments upon the series of circular metal discs at the side of the loom, taken as a whole. The holding mechanism consists of the double series of concentric portions of the surfaces of the segments on the series of circular metal discs at the side of the loom, which operate in conjunction with the projecting pins or rollers on the backs to lock or hold the jacks fast, and consequently the heddles, by mechanical opposition of these surfaces to the up-and-down movement of the jacks, when in their extreme elevated or depressed positions.

Int. 12. What capacity, if any, has the pattern mechanism in Model 5 of being changed?

220 Ans. It has an almost endless capacity of being varied.

Int. 13. How?

Ans. By changing the positions of the segments upon the circular discs, or by taking out some from the inner ring of segments, and placing others in the outer ring, or vice versa. Similar changes are common in all pattern barrels, or chains of cams, in pattern mechanism.

Int. 14. State how the pattern mechanism of Model 5 compares with the pattern mechanism attached to complainant's Model A, as respects the number of changes that can be made in the pattern woven.

Ans. The same number of changes can be made with each. There are eight bars of cams in the pattern chain of said Model A, and eight segments in Model No. 5; these cams may be shifted upon their respective bars; some of the cams may be taken off of the bars, or additional cams put on to any of them. They are both rotating pattern cam mechanisms; and, in the use of both, in order to change the pattern, the portions which determine the pattern must either be shifted, or taken out, or others substituted. I do not, however, consider the pattern mechanism of either of the models limited to the precise number of changes that can be effected by the precise pattern mechanism as it stands. In either of them the pattern mechanism may be extended by extending the number of cam bars and cams in the one case, and the

cam segments in the other case. This would involve a longer chain in the one case, and larger discs in the other.

Int. 15. State during how many consecutive picks of the shuttle the heddles in Model No. 5 can be held in their extreme elevated or depressed position.

Ans. As the pattern mechanism is now set, they can be held for six picks in their elevated position, being depressed two picks, but, as I have said before, by a change of segments they can be varied any number either the number of segments on each heddle; that is, they could be held either up or down seven picks, or any number less than that.

Int. 16. State whether or not the combination in said Model No. 5 of the jacks that operate the leaves of heddles, the lifters and depressers, the pattern mechanism for determining the pattern, and the mechanism for holding the jacks, either in their elevated or de-
221 pressed positions, when not required to be operated, is or is not substantially the same as the combination of jacks, lifter and depresser, pattern mechanism, and holding mechanism set forth in said Marshall's reissue patent.

Ans. It is substantially the same if the combination of said Marshall patent inquired of be a combination broadly of jacks that operate the leaves of heddles, lifters, and depressers to move the jacks from their extreme elevated to their extreme depressed positions or vice versa, a pattern mechanism for determining the pattern, and a mechanism for holding the jacks in their extreme elevated or depressed positions when not required to be operated. But if said combination be limited to the special jacks, lifters and depressers, pattern mechanism, and holding mechanism described in said patent, and to the special action or mode of operation of each of these parts in the combination, or to mechanical equivalents of each of them, respectively, having their specific properties and mode of operation, it is not substantially the same, in my opinion.

Int. 17. State whether or not you find in said Model No. 5 any, and, if any, what mechanism which accomplishes the result accomplished by the evener in the loom represented by complainant's Model A.

Ans. I do find in Model No. 5 mechanical devices which accomplish the most important result accomplished by the bar of the evener, viz., that of guiding and controlling the descent of the heddles and warp threads to their mean position, thus preventing the heddles being moved by the strain of the warp threads in advance of the movement of the lifters and depressers. This mechanism consists of inclined surfaces upon the segments of the circular discs, each of which inclined surfaces lie facing or opposite to the inclined surfaces which constitute the lifters and depressers. The inclined portions of the segments which lie opposite to the inclined portions of the segments which operate as lifters and depressers, resist the movement of the jack in advance of the movement of the lifter and depresser by operating upon the projecting pin or roller, which is also operated upon by the lifter and depresser, but on the opposite side of it. The effect of these moving inclined surfaces is to afford a constant mechanical resist-
ance at each point in the movements of the jacks, and conse-
222 quently the heddles, under the action of the strain of the tension of the warp threads, until they arrive at mean position. The evener in Model A accomplishes this by the movement of its roller bars on the inclined surfaces of the ends of the upper heddle levers which are immediately connected with the jacks. In Model No. 5 the

roller is on the jack; and the inclined surface, which governs the motion of the jack, is the moving surface, the two devices being very nearly identical as mechanical devices, but transposed. The incidental result performed by the evener in Model A of holding the jacks in their extreme elevated or depressed positions, in case they should become detached from the catches in Model A, is not performed by these inclined surfaces, but by the concentric surfaces near to them, or the segments.

F. C. TREADWELL, JR.

(Counsel for complainant declines to cross-examine.)

Deposition of Ira Allen, taken, subscribed, and sworn to before N. Austin Parks, examiner.

OCT. 2, 1866.

Int. 1. State your name, age, residence, and occupation.

Ans. Ira Allen; age, 39 years; residence, Winooski, Vt.; occupation at present and for the past eight years, iron founder.

Int. 2. State whether or not you have ever been engaged in weaving; if yea, when, where, and for how long.

Ans. I have; at Winooski, Lowell, and Utica, or near there. I worked at the business sixteen or seventeen years.

Int. 3. Where and how long did you work at weaving in said Winooski?

Ans. At the woollen mill called the Burlington Woollen Mill. I worked there about fourteen years at weaving.

Int. 4. Do you know Elisha Allen, and whether or not he is related to you; and, if so, how?

Ans. I do. He is my brother.

223 Int. 5. Do you know Moses Marshall, and where did you become acquainted with him?

Ans. I do. I became acquainted with him at Winooski.

Int. 6. State whether or not said Marshall started any loom at said mills; and if yea, when or about what time it was; and state how said loom, in its mechanical construction, compared with or differed from complainant's Model A, so far as the mechanism is represented therein.

Ans. He did, about '48 or '49; somewhere along there; I couldn't say positive. The levers here are different, because it was a broad loom. It had elbows at the bottom and top, as near as I can recollect now, in place of the heddle levers. I don't know about those gears, but there may be some alteration. I wouldn't state but what there was, but it's upon the same principle as the loom there, as far as I can see. The jacks are the same. I saw one of them yesterday; the pattern that the jacks was made from, I mean. The jack was riveted on to the side of the heddle lever instead of running through this slot. The pattern chain is the same as was on the loom, the Crompton chain. The spring catches were on and the shoulders on the jacks. The lifter and depresser was the same. I won't say positive that the eveners was just the shape. It was a long time ago, and I can't recollect every little thing about it.

Int. 7. State what said Marshall did in relation to said loom, and how long or about how long it was run, and in what room it was, as compared with that in which you were employed, and what your duties were at that time in said mills, and your opportunities of seeing the loom.

Ans. I can't tell just the time he was at work at the loom. I know he was a good while at it. It was in the room that I worked in. I was

then second hand in the weave room. I worked on the loom, and my brother worked on it too.

Int. 8. State, as nearly as you can, about how much was woven on said loom.

Ans. There wasn't not over two cuts, and I wouldn't say as there was more than half a cut wove on it, but not over two.

Int. 9. State, as nearly as you can, about how long said Marshall was at work on said loom; whether weeks or months.

224 Ans. I couldn't say how long he was at work on it, positive. I know he was there a good deal of his time, but I couldn't say how much.

Int. 10. State what became of the balance of the warp that was put in said loom, and was not woven in it.

Ans. It was taken out and put into another loom; a Crompton loom, the original loom.

Int. 11. How did said loom said Marshall started work?

Ans. It didn't work at all. You couldn't make it work, not satisfactory.

Int. 12. What were the difficulties in its operation?

Ans. I recollect one very well, that it made what we call false picks; kept a girl picking out all the time; wouldn't make perfect cloth.

Int. 13. Do you recollect anything about the operation of the evener and the spring catches?

Ans. I recollect about the spring catches, that he had some trouble about making 'em work, but I couldn't say what exactly. He had a good deal of trouble with the loom. I couldn't say about the evener exactly, but sometimes it would catch and throw the belt off.

Int. 14. What became of that loom?

Ans. Nobody, I guess, knows; I don't. The old loom is there now, and the old Crompton rigging on it running. I saw part of the lifting and depressing mechanism in the counting-room yesterday. I don't know what became of the other. I suppose it was thrown into the old iron. They generally throw such stuff, where it is of no use to them, into the old iron, and sell it.

Int. 15. After said Marshall had started said loom, was it ever altered; and if yea, how altered?

Ans. It was altered back to the original loom.

Int. 16. Please state whether or not, after said loom was altered back into the original loom, it was operated for practical weaving.

Ans. Yes, sir. It worked just as well as any of them, of the Crompton looms, for aught I know.

Int. 17. About how long a time was occupied in weaving a cut on the loom when so altered back into its original condition?

225 Ans. I couldn't state exactly the time; we generally take about two days to weave a cut.

Int. 18. How, in respect to its value for weaving purposes, was said loom, when altered and started by said Marshall, as compared with what it was before it was so altered?

Ans. I don't know how you would compare it. You could do nothing with that one, and the others were good looms. If it had been a better loom, of course we shouldn't have altered it back.

Int. 19. Which one do you mean you could do nothing with?

Ans. The Marshall loom, as it was called.

Int. 20. State what knowledge of practical weaving you had at the time that said Marshall started that loom. How long had you then been a practical weaver?

Ans. It may be three or four years; perhaps longer, perhaps a little less; I couldn't say as to that.

Int. 21. State how many Marshall looms, such as you have mentioned, you ever saw besides the one that you have mentioned and Model A.

Ans. I never saw any other. I heard they had one at Lowell; that's all. I heard of it when I worked there; that they had one in, and took it out. I believe it was in the No. 3 mill, Middlesex. I wouldn't be positive which mill, but it was on the Middlesex.

Int. 22. Did you work at said Lowell before or after said Marshall started his loom at the Burlington Woollen Mills?

Ans. After he started it. Mr. Marshall was at work in Lowell when I came there, at his machine shop.

Int. 23. State whether you mean by the word "Middlesex," in your 21st answer, the Middlesex Mills.

Ans. Yes, sir.

IRA ALLEN.

(Counsel for complainant declines to cross-examine.)

226 FEBRUARY 14*th*, 1867.

The defendants here put in evidence certified copy of letters patent granted to Moses Marshall, Dec. 11, 1849, marked "Exhibit 7, N. A. P., Ex'r." Also, certified copy of letters patent granted by United States to William Crompton, Nov. 25, 1837, marked "Exhibit 8, N. A. P., Ex'r." Also, copy of specification and drawings of letters patent granted by Great Britain to John Rostrom, enrolled Oct. 29, 1839, marked "Exhibit 9, N. A. P., Ex'r." Also, the model marked "Exhibit No. 10, N. A. P., Ex'r." being the model of said William Crompton, filed with his application upon which said letters patent to him issued.

Exhibit No. 7.—N. A. P., Examiner.

The United States of America to all to whom these letters patent shall come:

Whereas Moses Marshall, of Lowell, Mass., has alleged that he has invented a new and useful improvement in looms for weaving figured fabrics, which he states has not been known or used before his application; has made oath that he is a citizen of the United States, that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

227 These are therefore to grant, according to law, to the said Moses Marshall, his heirs, administrators, or assigns, for the term of fourteen years from the eleventh day of December, one thousand eight hundred and forty-nine, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said Moses Marshall in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

[SEAL.]

Given under my hand at the city of Washington, this eleventh day of December, in the year of our Lord one thousand eight hundred and forty nine, and of the independence of the United States of America the seventy-fourth.

T. EWING,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.

THOS. EWBANK,
Commissioner of Patents.

The schedule referred to in these letters patent and making part of the same.

To all persons to whom these presents shall come:

Be it known that I, Moses Marshall, of Lowell, in the county of Middlesex, and State of Massachusetts, have invented certain new and useful improvements in looms for weaving all kinds of plain, twilled, and fancy cloths, and that the following description, taken in connection with the accompanying drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvements by which my invention may be distinguished from others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent. The figures of the accompanying plates of drawings represent my improvements.

228 Fig. 1, Pl. 1, is a front elevation of my improved loom; Fig. 2, Pl. 2, is an elevation of one end; Fig. 3, Pl. 2, is an elevation of the opposite end; and Fig. 4, Pl. 3, is a vertical section taken at about the centre of the loom just in front of the cam shaft, hereinafter referred to, and parallel to the front of the loom.

The loom, as represented in the drawings above referred to, is completely equipped for use; but it differs from the best cloth looms now in use, essentially, only in that portion of the machinery which operates the harness and decussates or shifts the warp. In the common "cam" loom, as it is called, when it is desired to change the number of sheds in the warp, in order to vary the pattern of the cloth, it becomes necessary to take the loom apart and alter the proportion of the gearing which drives the cam shaft. This, of course, occasions great delay, and enhances the cost of weaving by this machine. Again, in the "Crompton" loom (so named from the inventor thereof), all the various sheds of the warp are changed every time the filling thread is passed through with the shuttle, which wears the warp extensively, and thereby injures the fabric, and indeed renders the loom unsuitable for the weaving of doeskins. In this Crompton loom, also, the arrangement is such that the filling threads are always put in when the warp is slack, so that when the lay beats up the filling, it does not make so close a fabric as is necessary for satinets, cassimeres, and doeskins.

All these difficulties are successfully obviated by my improvements; and in the loom as I construct it, any number of harnesses and different sheds of the warp, from three to twelve or more, may be arranged and held stationary or brought into use, according to the pattern of the cloth or the nature of the fabric to be made.

The elementary features of my improvements consist in a series of stationary rests, which support the jacks of the harness, when sheds operated by them are not in use; the chain shafts and lifting and depressing bars for operating the jacks and harness; and the evener (as

I term it), which is composed of two rollers, set in a frame having a reciprocating rectilinear motion, which rollers press against the bevelled ends of the harness, and assist in shifting the sheds of yarn and, what is more essential, operate always to keep the levers even, for the proper operation of the cams on the pattern chain.

The detailed construction of the several parts above referred to, and their connected operation, are explained in the sequel; but it will be necessary, in order to avoid confusion, to first refer to the main parts of the loom, which are old and in common use.

A A A A, in the several drawings, is the main framework of the machine. B B is the driving shaft. C C is the warp bearer from which the warp threads are unwound, and pass over the smaller roller D D, set just above the one just named. E E E E is the lay, with its reed F F, and the shuttle-box G G, on each side. Over each of said boxes is a picker rod H H H H, on which the pickers I I slide forward and back to throw the shuttle. K K-K K are the picker levers or arms which move the pickers, said levers being operated from the cam-shaft L L, through the medium of the connecting rods M M, and vertical arms N N, extending up from the cross-shafts O O-O O. These cross-shafts are rocked so as to move the picker arms by means of their bearing plates P P, on which the cams on the shaft L L operate in a manner which is well understood by those engaged in weaving. Q Q, Fig. 1, Pl. 1, is the cloth beam on which the fabric is wound after it is woven. R R is the shaft which drives the lay by means of the crank rods S S, Figs. 2 and 3, Pl. 2. This shaft also operates the apparatus herein above referred to, for springing the harness, which apparatus I shall now proceed to explain.

a a a a, in the several figures, is the framework which supports the main portion of the harness or heddle apparatus. b b b b, &c., are the upper harness levers, which are connected to heddles of any number of warps by means of the cords c c-c c, and double-spring plates d d, &c., arranged as shown in Fig. 1, Pl. 1, and Fig. 4, Pl. 3, at one end of said levers. These levers have a fulcrum, and turn on the short cross-shaft, e e, which has suitable bearings, in vertical uprights f f (Fig. 1, Pl. 1, and Fig. 4, Pl. 3), which are fastened to the framework a a a, &c. The outer ends of these levers b b are connected to the several jacks g g g-g g g g by a pivot joint, as shown in the figures last referred to. These jacks are all of them forked at their lower ends, as shown in the front elevation and sectional view, Fig. 4, Pl. 3, of the loom, and have near the bottom of each prong of their forks g g an interior and exterior step or shoulder, as shown respectively at h h, &c., and i i, &c. The interior steps h h are operated upon by the elevating and depressing bars k k and l l, which extend between the two endless chains m m-m m, operated by the toothed and plain wheels n-n-n-n on the opposite ends of the two shafts o o-o o, having proper bearings in the framework a a a, by the revolutions of which shafts the said elevating and depressing bars are operated and move the jacks and harness levers in a manner which will be well understood. The exterior steps or shoulders i i of the jacks g g g, &c., are for sustaining such heddles or harness as are not in use for the formation of the particular fabric which is in process of weaving on the loom, but which are wanted in other kinds of cloth, which it is desirable to weave in the same loom. These exterior shoulders drop, or are sustained on the series of rests p p p-q q q, set in hollow boxes r r-s s arranged on each side of the jacks, and attached to the framework a a a, as shown in the several drawings. Each of these rests has a small tongue t u, cast on the upper side of those

denoted at p p, &c., and on the under side of those represented at q q q, which fits between one side of the box r r or s s, and the long plate v-w, extending one across each of said boxes, and attached to a turning rod y-z, having a spiral spring so wound round it as to press said rest outwards. The outer ends of these rests are bevelled, or chamfered off a little, as shown in Fig. 1, Pl. 1, and Fig. 4, Pl. 3, so as to correspond with, or be worked by, a similar bevelled face, formed on the exterior shoulders of the jacks, as shown in the figures before referred to. When the jacks are kept in operation by the cams on the pattern chain (hereinafter referred to), these rests will be pressed back, and allow the jacks to pass without obstruction, by the arrangement of bevelled faces on said jacks and rests, as above described; but when the jacks are not pressed upon by the cams on the pattern chain, they will be supported on said rests as herein before suggested. The lower outer ends of the jacks are connected b the metallic wires a^1 a^1-a^1 a^1 to the ends of the lower set of heddle levers b^1 b^1-b^1 b^1, which have their fulcrum and turn on the short shaft c^1 c^1, Fig. 2, Pl. 2, in a manner which is well understood.

231 These wires are stretched in a diagonal direction so as to draw the shoulders of the jacks (when they are not pressed by the cams) over and upon the rests above referred to.

The shafts o o-o o, which carry the elevating and depressing bars, k k-l l, and move the jacks, are revolved by means of a bevel gear-wheel d^1, on one end of the upper shaft o o, which, by means of the bevel gears e^1 f^1 g^1 (arranged as clearly shown in Figs. 2 and 3, Pl. 2), connects with a system of eccentric gear-wheels h^1 i^1 k^1, the former two of which have bearings in proper boxes attached to the framework a a a, &c., and the latter of which is arranged on one end of the long shaft R R, which derives its motion through the medium of the spur gear-wheels n^1 n^1, form the cam-shaft L L, hereinbefore referred to. The use of these eccentric gears, as will readily be perceived, give a varying motion to the heddles, and are so arranged as, in "shedding" the warp, to move it most rapidly just when it is shifted, or the two threads of the warps pass the plane of decussation, in order to catch the filling before the lay, which has beat it up, leaves it; thereby making a much closer fabric than is ordinarily produced.

The pattern chain, as it is termed, is composed of the two endless chains o^1 o^1-o^1 o^1, between which are stretched the cross-rods p^1 p^1 p^1, on which the circular cams or rollers q^1 q^1 q^1, which may be moved along on said rods, so as to vary the pattern by operating on different jacks against which they press. This pattern chain, with its rollers and rods, is hung over, and turned with the shaft r^1 r^1, Fig. 2, Pl. 2, which shaft is revolved by means of a ratchet-wheel S^1, on one end of said shaft, operated by the catch t^1, said catch being moved by a crank-rod u^1 u^1, shown by dotted lines in Fig. 4, Pl. 3. One end of this crank works in a slot of one arm of the right-angular lever v^1 v^1, to the other arm of which the catch t^1 is connected, as shown by dotted lines in said Fig. 4. The other end of the crank rod is connected eccentrically to the face of the gear-wheel w^1, which is revolved by the gear-wheel x^1, on the upper shaft o o, which drives the jacks as hereinabove explained. The motions of the pattern chain are regulated by the notched wheel y^1 (on the front end of the shaft r^1 r^1) and spring pall z^1, arranged as shown clearly in Fig. 1, Pl. 1.

232 It now only remains for me to describe the "evener," as I have hereinabove termed it, which works with a heddle or harness lever, so as to assist in shifting the sheds, and to keep said levers in accurate position for the operation of the cams.

This evener consists of two rollers a^2 a^2 b^2 b^2, which are set and have bearings in the forked ends c^2 d^2 of two horizontal bars e^2 e^2-e^2 e^2, said bars being arranged so as to move forward and back in proper guides, or holes, formed in the upright and curved supports f^2 g^2, attached to the top of the framework a a a. These rollers press against the outer bevelled ends of the upper harness levers b b-b b, shaped as shown in Fig. 1, Pl. 1, and Fig 4, Pl. 3, and, as will be palpable, serve the purpose hereinabove suggested. A reciprocating rectilinear motion is imparted to this "evener" by means of the crank-arms, h^2 h^2, on opposite ends of the shaft i^2 i^2 (having proper bearings depending from the framework a a a). said crank-arms being attached to one end of the connecting rods k^2 k^2, the other ends of which rods are connected to the sliding bars e^2 e^2 e^2 e^2, as shown in Fig. 1, Pl. 1. The shaft i^2 i^2 is vibrated or rocked, so as to give the requisite motion to the "evener" through the medium of the several parts arranged or connected, as above described, by means of the crank-arm i^2, and connecting rod m^2 m^2, the lower end of which is attached eccentrically to the middle wheel i^1 of the eccentric gears, hereinabove referred to in the machinery for driving the jacks.

Having thus described my improved loom, I shall state my claims as follows: What I claim as my invention, and desire to have secured to me by letters patent, is the improvement hereinabove described, in the machinery for operating the harness so that any proper number of heddles may be used, or changed, as desired, without taking the loom to pieces; said improvement consisting, first, in providing the movable spring-rests for supporting the jacks of the harness when they are not in use, and which are sprung back by the bevel face on the shoulders of the jacks when they are kept in play by the cams on the pattern chain, the whole arrangement being substantially as hereinabove set forth; and, second, in the "evener," constructed and operating as
233 herein described, for assisting in moving the upper heddle-levers, and keeping them even, so that the cams or rollers on the pattern chain will operate accurately on the jacks, as specified—meaning to claim the exclusive use of said spring rests and "evener" in a loom, the invention of which is entirely original with me.

I also claim the combination of rotating, lifting, and depressing bars, arranged in endless chains, so as to revolve, as described, with the forked jacks, having internal shoulders, as specified.

In testimony that the foregoing is a true description of my said invention and improvements, I have hereunto set my signature this twenty-ninth day of October, A. D. 1849.

MOSES MARSHALL.

Witnesses:
EZRA LINCOLN, Jr.
HENRY G. CLARK.

Exhibit No. 8.—*N. A. P., Examiner.*

The United States of America to all to whom those letters patent shall come:

Whereas William Crompton, of Taunton, Mass., has alleged that he has invented a new and useful improvement in the figure power loom, which he states has not been known or used before his application; has made oath that he has resided one year previous to his application, and that he intends becoming a citizen of the United States, that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his

knowledge and belief, been previously known or used; has paid
234 into the treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent be granted for that purpose:

These are therefore to grant, according to law, to the said William Crompton, his heirs, administrators, and assigns, for the term of fourteen years from the twenty-fifth day of November, one thousand eight hundred and thirty-seven, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said William Crompton in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof, I have caused these letters to be made patent. and the seal of the Patent Office has been hereunto affixed.

[L. S.]

Given under my hand, at the city of Washington, this twenty-fifth day of November, in the year of our Lord one thousand eight hundred and thirty-seven, and of the independence of the United States of America the sixty-second.

JOHN FORSYTH,
Secretary of State.

Countersigned and sealed with the seal of the Patent Office.
HENRY L. ELLSWORTH,
Commissioner of Patents.

The schedule referred to in these letters patent and making part of the same.

To all whom it may concern:

Be it known that I, William Crompton, in the county of Bristol and State of Massachusetts, have invented certain improvements in the figure, or fancy power loom, by means of which improvements the power of extending and varying the figure is greatly increased, whilst
235 the required changes therein are much facilitated; and I do hereby declare that the following is a full and exact description thereof:

Fig. 1 is a perspective view of the whole machine, (*AA*) being the frame, (*B*) the breast beam, and (*C*) the lathe, together with which other parts of the loom are represented which do not need description, not being new. (*DD*) are the jacks which operate the harness, of which, with their corresponding levers (D^1D^1), there may be any desired numbers. (*EE*) is the apparatus by which the jacks are thrown out. In the drawing it is represented as in the form of a cylinder, consisting of six bolts, or rods, running from end to end, and having on them shifting rollers which project from them and come into contact with the jacks, throwing them out as required by the pattern.

One of those shifting rollers is seen at (*A*), Fig. 2, shows one of these bolts with the rollers on it, (*aa*) being the rollers which are slid on to the bolt, and are retained in their places by tubes placed between them, which also slide on to the bolts. and are made of such lengths as are required to keep the rollers in their proper places. When a larger number of changes are required than can be obtained from placing the bolts with their rollers around a single cylinder, they are so arranged as to form an endless chain of bolts and rollers, which pass round a cylinder

situated like that represented, and also round another placed below it, or otherwise conveniently situated.

The only office performed by the rollers above described is the throwing out of the jacks, the lifting and depressing being affected by an apparatus for that especial purpose, to be now described.

(*F*) is a lifting rod, which extends across the jacks (*DD*), and catches under the offset or projection (*bb*) upon them, when they are thrown out, and, as it rises, raises them and their levers.

(*G*) is a similar rod for carrying those jacks down which are not raised by the first rod. (*H*) is the sliding bar to which the rod (*F*) is attached, the operation of which will be best seen in Fig. 3, which is a back view of the loom.

In this figure, (*I*) is the driving shaft, the cranks (*JJ*) of which work the lathe. (*K*) is a crank for working the lifting and depress-
236 ing rods of the jacks. This crank is connected to the slide bar (*K*) by means of the shackle bar (*L*), which it raises and lowers as it does also the sliding bar (*H*) carrying the lifting rod (*F*), there being two pulleys to communicate motion from one to the other, as seen in the drawing.

The wrist of the crank (*K*) may be made to shift. The shaft (*M*) regulates the action of the shuttle, and also that of the apparatus which throws out the jacks. (*N*) is a ratchet-wheel placed upon this shaft; and (*O*) is a stirrup or draw catch, which is jointed on to the upper end of the lathe, and as this is made to vibrate by the crank (*JJ*), the stirrup catches a new tooth on the ratchet-wheel, and carries the shaft (*M*) to the required distance.

The bevel-wheel (*P*), Fig. 1, is on the end of this shaft, and into this gears the small bevel-wheel (*Q*) upon the shaft of the roller cylinder, and it will be seen, therefore, that this cylinder may have the proper motion communicated to it at every beat of the lathe. The two notched wheels (*RR*) on the shaft (*M*) are for working the pick and throwing the shuttle. As the lathe vibrates, the projecting part of one of these wheels comes into contact with a bell crank which throws the pick, as in some other looms, whilst at the opposite end one of the notches clears the crank, and so on alternately.

The spring (*S*), which presses upon the lower levers (*TT*), serves to bring them regularly in place.

On the end of the shaft (*M*) there is a check-wheel (*U*), having as many depressions on its periphery as there are teeth on the ratchet-wheel, into which depressions the curved end of a spring passes to hold the shaft steady during the intervals of motion. Fig. 4 is one end view of this check-wheel and spring; and Fig. 5, one of the jacks with its offset for lifting and depressing.

What I claim as my invention, and wish to secure by letters patent, is the entire manner of constructing and combining the apparatus for working the jacks as herein described, consisting essentially of the lifting and depressing rods, the rods with rollers for throwing out the jacks, arranged upon a cylinder or otherwise, the lifting rods, and the upper shaft with its connection by gearing with the roller cylinder.

237 I also claim the two notched wheels upon the upper shaft, as constructed, combined, and used, for working the pick.

WILLIAM CROMPTON.

Witnesses:

LINTON THORN.

B. K. MORSELL.

Exhibit No. 9.—N. A. P., Examiner.—Rostron's specification.

To all to whom these presents shall come:

I, John Rostron, of Edenfield, in the county of Lancaster, manufacturer, send greeting.

Whereas her present most excellent Majesty Queen Victoria, by her letters patent, under the great seal of Great Britain, bearing date at Westminster, the thirtieth day of April, in the second year of her reign, did, for herself, her heirs, and successors, give and grant unto me, the said John Rostron, her especial license, full power, sole privilege, and authority, that I, the said John Rostron, my executors, administrators, and assigns, and such others as I, the said John Rostron, my executors, administrators, and assigns, should agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England and Wales, and the town of Berwick-upon-Tweed, an invention of "certain improvements in the construction of looms for weaving," which has been communicated to me by a certain foreigner residing abroad; in which letters patent is contained a proviso that I, the said John Rostron, shall cause a particular description of the nature of the said
238 invention, and in what manner the same is to be performed, to be enrolled in her Majesty's high court of chancery within six calendar months next and immediately after the date of the said in part recited letters patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

Now know ye, that in compliance with the said proviso, I, the said John Rostron, do hereby declare that the nature of the said invention, and the manner in which the same is to be performed, is particularly described and ascertained in and by the drawings hereunto annexed, and the following explanation thereof, that is to say:

These improvements in the construction of looms for weaving consist principally in the application of a novel and peculiar arrangement of mechanism for the purpose of affording a much greater extent and variety of operations in those parts of looms which are employed to form or work patterns or devices in the cloth or fabric to be woven, that is in the working of the harness or healds, which, in connection with the suitable actions of the treadles and jacks, effect the requisite shedding of the warp threads to produce the pattern. These improvements are applicable to the weaving of any description of plain or twilled fabrics, but more particularly to figure or fancy looms for weaving patterns or devices in or upon the cloth or other fabric, and are principally intended to supersede the "Jacquard," or any similar figuring apparatus; they have also for their object a great economy of both material, labor, and expense, in effecting the requisite changes of patterns by a ready mode of altering or removing those working parts of the loom which produce the design by their action upon the jacks and treadles, which shift the healds, or harness, and consequently by the use of the endless chain of any extent possess the capability of producing an extended range of pattern before it is necessary to repeat the shedding, or recommence the same series of operations upon the harness, commonly called renewing "the round." The improvements are effected by the application of an endless, or continuous chain of tappets of a novel and peculiar construction, formed by a succession of side-links, connected by transverse spindles or bolts, upon or round which are placed, at suitable distances apart, small bowls or rollers, as tappets of various widths, turning loosely
239 or otherwise upon such spindle, which bowls or rollers are sepa-

rated by collars, or tubes, of various lengths, according to the distances required between such tappets. An endless, or continuous chain so constructed (as hereafter will be more minutely detailed), is to be suitably applied to the loom for the purpose of "throwing out" certain parts of the mechanism connected with the jacks and treadles, and with their lifting and depressing apparatus, by means of the bowls, or rollers, as the continuous chain revolves, pressing against certain rods, bars, or levers called "jack-lifters," connected with the jacks above, and the treadles below, which will by these means throw out or disengage, at the proper periods, certain of those jack-lifters from the action of the lifting and depressing apparatus, and leave certain others of them to be brought or conducted, by suitable wires or strings, under the operations of the lifting and depressing apparatus, by which means the harness, or healds, will be caused to shed or divide the warp threads, as required. In order that these improvements may be more distinctly explained, and perfectly understood, I have attached to these presents a sheet of drawings, containing such views of the improved mechanism, and its mode of application to looms in general, as will be sufficiently explicit to those acquainted with the construction of looms.

The improvements represented in the drawings attached are shewn as applied to a power loom for weaving fustians; but it will be quite evident to the practical weaver that they are equally applicable to any other construction of power or hand looms, wherein the Jacquard or any similar apparatus has usually been employed to produce the pattern or figure. And I would observe that, for the sake of distinction, I have represented such parts and combinations of mechanism which are new, and constitute these improvements, as shaded, and the rest or ordinary parts of the machinery in outline only, having marked the various figures with similar letters of reference, placed upon corresponding parts of the apparatus in all the figures.

Description of the drawing.

Figure 1 represents in elevation the back part of a power loom for weaving fustians; Figure 2 is an end elevation; Figure 3 is a
240 front elevation; and Figure 4, a plan or horizontal view of the same as seen from above, in all of which the improved combinations of mechanism or apparatus for producing the figure or pattern is shewn applied to the side of the loom, the whole being drawn upon a scale of one inch and a half to the foot; Figure 5 is a front, and Figure 6 a side view of the improvements, represented detached from the loom upon an enlarged scale, that is, one-fourth the real size; Figures 7 and 8 represent a portion of the peculiar construction of endless chain, which constitutes the essential feature of novelty in the application of these improvements, which figures are drawn on a scale of one-half the real size. Figures 9 and 10 represent detached front and side elevations of a portion of the improved mechanism for driving the chain, somewhat differently modified from that shown at Figures 1 to 6. This it will be perceived is similar in principle to the former, but is represented in order to shew the method of attaching these improvements to looms of the old construction.

In Figures 1, 2, 3, and 4, *a a a a* represent the side and cross framing of the loom, which supports the warp-beam *b b*, from whence the warp threads pass over the guide or tension roller *c*, and through the healds *d d*, over the breast-beam *e*, and around the work or cloth beam *f f*, also supported in the framing *a*. *g g* is the vibrating lathe or slay

carrying the reed for the purpose of beating up the work, which is actuated by the crank-shaft *h*, and driving pully *i*, as usual; the harness or healds *d d* being suspended from the jacks *j j*, and connected to the treadles *k k* below. A ratchet-wheel *n* is keyed fast upon a horizontal shaft *o o*, extending through about the centre of the loom, and which is supported in the upright side-frames *a a*. Now, as the lathe *g* vibrates backward and forward (driven by the rotation by the crank-shaft *h*, and the connecting links *l l*), a rachet or draw catch *m* attached to the arm of the lathe, and taking into the ratchet-wheel *n* on the shaft *o*, draws or pulls that wheel and shaft round one tooth at every beat of the lathe. Upon each end of this shaft *o o*, there are also keyed tappets or notched wheels *p p*, and it will be seen in the plan, Figure 4, that as these tappet-wheels *p p* revolve, they alternately present their projecting portion to one or the other of the small bell-
241 crank levers *q q*, and by striking the bell-crank lever cause the picking-stricks *r r*, attached to it by a strap, to impel the shuttle *s* across the shuttle race, and thereby to put in the weft or shute, whilst the notched space upon the other tappet-wheel *p* at the reverse end of the shaft clears the crank, and so on alternately. This horizontal shaft *o o* also carries at its extremity a bevel toothed wheel *t t*, which gears into a corresponding pinion *u* of half its diameter (see the enlarged and detached Figures 5 and 6), in order to obtain a quick action of the chain bowls upon the jack lifters during the interval of shedding the warp threads. The pinion *u* is fixed upon the end of a small transverse shaft *v*, this shaft having semi-circular flutes or recesses made longitudinally in its periphery. In these cylindrical flutes or recesses and around this shaft *v*, the endless chain *w w* passes, being driven by means of the bevel-wheels *t* and *u*, and kept in its proper situation by the flanges v^1 upon the shaft *v*, the bowls or rollers w^1 w^1, of which it is partly composed, lying in the fluted recesses of the said shaft. The peculiar construction of this endless chain will be clearly understood by reference to Figures 7 and 8; it is composed of separate side links A A, which are jointed or connected together by means of the bolt or spindle B B passed through their eyes. On these spindles are placed the small rollers or bowls C C, which are allowed to turn loosely or otherwise upon the spindles, these rollers or bowls being kept at any required distance asunder by means of small loose tubes, collars, or washers D D, slipped upon the spindles between the rollers or bowls. I have used the links made of light plate iron punched out to the required form, the spindles of iron wire, the collars or washers of ordinary thin sheet-iron tubing, and the bowls or rollers of pot or earthen-ware, glass, iron, or any other metal, or wood, or other suitable material; but those made from pot or earthen-ware are decidedly the best and cheapest. It will be evident that such being the simple construction of the chain, the positions, breadths, and numbers of the rollers or bowls, and the length of the intervening tubes or collars, may be very readily varied by shifting upon the spindles, and thereby the pattern to be woven altered at pleasure; and it will also appear to persons conversant with weaving
242 machinery, that upon the positions, breadths, and numbers of these rollers, or bowls, the pattern to be woven must depend.

Having now described the peculiar construction of endless chain, I will proceed to describe its office and effect upon the working of the loom. The horizontal fluted shaft *v*, around which the chain is passed, and by which it is conducted, having by the bevilled or spur gearing advanced the chain one link at every beat of the lathe, it will be obvious that the bowls w^1 w^1 successively come in contact with and press

against the sides or edges of the jack-lifters x x exactly at the periods when the bowls pass the horizontal plane of the centre of the shaft v, and thereby project, or, as it is commonly termed, "throw out" the jack-lifters, x x, the bowls or rollers being combined or prepared of various breadths, in order that they may at each operation act against any number of jack-litters which the intended pattern may require. The jack-lifters x x are connnected at their upper ends to the jacks j j above, and, by conducting strings or wires y^* y^*, to the treadles k k below. These jack-lifters are formed each with four hooks or bearings, two being upon each side. I would here remark that these jack-lifters are well known, being the same instruments as have been heretofore used in various positions for the purpose of actuating the jacks and treadles for effecting the shedding or opening of both sheds of the warp simultaneously, excepting that these improved jack-lifters x x are provided with two hooks or bearings both at the back and front. By these means the jack-lifters are rendered capable (when combined with certain other arrangements of the improved mechanism hereinafter described) of producing patterns or devices upon cloth, that if woven by the agency of the "Jacquard" or the "wizard" (which are also endless or continuous pattern chains), or any other machine or apparatus heretofore used, would require double the number of shifts or changes to the round, to produce the same effect. There is a comb-bar fixed in the framing, seen in section at 13 in Figure 6, having partitions for the purpose of separating the jack-lifters x x, and keeping them always opposite to the acting peripheries of the chain, bowls, or rollers, and the back of the bar forms a guide conducting the chain and preventing
243 it from interfering with the jack-lifters below the horizontal plane of the shaft v. This comb-bar is provided with two lock-nuts for the purpose of adjusting it. The jack-lifters are to be raised and depressed by the transverse bars y^1 and y^2, shewn attached to vertical slide rods z z, in Figure 5, and in section in Figure 6, in which two of the jack-lifters only are represented. In this last-mentioned figure it will be observed that by the action of the chain-bowls the jack-lifter x^1 il thrown out of the reach of the lifting-bar y^1 as it ascends, represented by dotted lines, and thus thrown into a suitable position to be depressed by the bar y^2, whilst the jack-lifter x, by the stringing y^*, is brought into a suitable position to be raised by the bar y^1 as it descends. Thus it will be understood that those jacks and treadles, with which the jack-lifters x^1 are acted upon by the descending bar y^2 in connection, will constitute rising threads in the warp, and those jacks and treadles connected at the jack-lifters x, which are acted upon by the raising bar y^1, will constitute sinking threads on the warp, and thus produce the pattern in the fabric as the weaving proceeds. The raising and depressing bars y^1 and y^2 slide vertically in mortices in the frame attached to the loom side as seen in Figure 6, and are affixed by their adjusting screws to upright rods z, z, sliding also vertically in a part of the frame as seen at Figure 1. The alternate rising and falling movements of the bars y^1 and y^2 are performed simultaneously with the advance of the endless chain, by means of the crank or eccentric-pin 1, fixed in the side of the spur-wheel 2, upon the end of the crank-shaft h (see Figure 2 and Figure 4); as this wheel 2 revolves, the connecting-rod 3, attached by the link 4 to one of the two upright rods z, slides this rod up and down at each revolution, and the rods z z, being connected together by means of straps passing over the pulleys 5 and 6, causes the bars y^1 and y^2 to be raised and depressed alternately. It must be here observed that these raising and depressing bars y^1 y^2 are also peculiar in their form, being made

taper, that is, narrowed from the back towards the front, as the back-most healds will require to be separated further apart than those in front, in order to bring all the warps of each distinct shed into coincidence, which has the peculiar effect of causing the shed to be evenly made throughout instead of leaving any of the back warps loosely
244 or unevenly spread, which is of considerable importance, in order to leave a free and clear passage for the shuttle; and also that there is a spring 7 pressing a piece of leather against the side face of the driving bevilled wheel *t* to produce friction, in order to prevent any rebound or over-rim of the chain, and give steadiness to its rotation. It will be seen that the jack-lifters *x x* are always kept close against and made to return to the action of the chain by means of the conducting wires or strings *y**, by which they are connected to the treadles, being placed obliquely, thereby dispensing with a spring which would otherwise be required to each jack-lifter in the pattern looms as hitherto used, and that the treadles only require a slight steadying motion to bring the healds level when in the rest or quiet position which is effected by the straps and pulleys 8, also actuated by the spur-wheel 2, driving the wheel 9 and connecting-link 10, or by any other suitable arrangement, and it will be perceived that by this steadying motion thus geared the steadying motion may be readily adjusted to bring the treadles and jacks level or square in the rest position, or at any other required time.

Now, supposing the above-described combination of mechanism and its application to the loom to be fully understood, I would here observe that by a simple alteration in the mode of working these improvements another very important object can be obtained. By removing the link or arm 3 and substituting one of about double its length, the motion being communicated from the ordinary "taking-up" wheel 11, fixing the lower end of such arm to the pin 12 in the arm of the lever wheel 11 (as shewn by the red line in Figure 2), and also either by having an odd link or two similar rows of rollers and collars placed together in the same round in the endless chain *w w*, I am enabled to effect or work a double number of shifts or changes to the round, as each of the lifting-bars y^1 y^2, having two books or bearings on either side, will both perform the lifting and depressing motion alternately, and as the taking-up wheel 11 only performs one revolution to two of the crank-shaft, the pattern will be thus woven upon both surfaces of the cloth, but in reversed positions. As, for example, in weaving a plaid of any required square or pattern, it will be seen that when the crank-pin 12 in the
245 wheel 11 is passing the horizontal plane of the centre of the wheel on that side represented in Figure 2, the first acting link or row of the bowls in the endless chain which forms the pattern will throw out the required number of jack-lifters *x*, to the action of the depressing bar y^2, and by means of the conducting wires *y** cause the said disengaged jack-lifters to be brought against the opposite bar y^1 ready to be raised. Thus it will be perceived that on the following revolution of the endless chain the crank-pin in the wheel 11 will, by passing the horizontal plane of the centre of the wheel 11 at the opposite side (as shewn in red lines in Figure 2), cause those jack lifters *x* which were before depressed to be lifted, and consequently produce the pattern reversed upon the cloth, and so on alternately. The loom thus arranged may also be made to work two ordinary calico healds for weaving stripes, or ribs, or plain calico, cloth, or ground, by attaching their jacks direct to the lifting-bars y^1 y^2 (shewn also in red in Figure 2), in conjunction with any pattern to be effected by the endless chain. In those cases where it is desirable to attach these improvements for pro-

ducing the pattern or figure to old looms, it is only necessary to adopt the method represented in Figures 9 and 10, wherein the whole of the apparatus connected with the chain for producing the figure will be found to be the same as already described excepting in the mode of driving. In these Figures 9 and 10 the motion for working the chain is to be communicated directly from the ordinary crank-shaft of the loom *a* by means of the eccentric *b*, link *c*, and slide-rod *d*. Upon this slide-rod *d* the draw-catch *e* is attached for pulling round the ratchet-wheel *f* and driving the chain by means of the toothed wheel and pinion *g* and *h*, when the operation of the loom will proceed, as before explained.

Having now described these improvements in the construction of looms for weaving, I desire it to be particularly understood that although I have in this my specification and drawings described and shewn many parts common to looms in general and heretofore well known and in ordinary use in the trade, yet I hereby declare that they have been only represented for the sake of shewing the immediate application of these improvements, and to which old parts of course I make no
246 claim; but I do claim exclusively the peculiar construction of the endless chain composed of side-links, spindles, or bolts, tubes, washers, or collars, and rollers, or bowls, revolving loosely or otherwise, and capable of being readily changed and adjusted, of whatever material they may be constructed, as shewn particularly in Figures 5, 6, 7, and 8, for producing the pattern or figure upon the cloth or fabric in looms for weaving, and the application of such thereto, also its employment in conjunction with the taper-formed lifting and depressing bars or arms y^1 and y^2 working in combination with the vertical sliding-rods *z z*, for actuating the jacks and treadles, and also in combination with the jack-lifters provided with two hooks or bearings on each side, that is, on the back and front, in order to perform the requisite and ever shedding of the warp threads; and further, the manner of stringing and connecting the jack-lifters to the treadles by placing the conducting strings or wires y^* inclined out of the perpendicular in order to dispense with the necessity of separate springs in such or similar situations in looms for weaving.

In witness whereof, I, the said John Rostron, have hereunto set my hand and seal, this twenty-eighth day of October, in the year of our Lord one thousand eight hundred thirty-nine.

JOHN (L. S.) ROSTRON.

And be it remembered that, on the twenty-eighth day of October, in the third year of the reign of her Majesty Queen Victoria, the said John Rostron came before our said lady the Queen in her chancery, and acknowledged the instrument aforesaid, and all and everything therein contained and specified, in form above written. And also the instrument aforesaid was stamped according to the tenor of the statute made in the fifty-fifth year of the reign of his late Majesty King George the Third.

Inrolled the twenty-ninth day of October, one thousand eight hundred and thirty-nine.

247 COMPLAINANT'S REBUTTER.

Deposition of Horace Wyman, taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEB. 13, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. Horace Wyman; age, 38; residence, Worcester, Mass.; occupation, machinist.

Int. 2. Are you employed in the mill of George Crompton, the complainant, at Worcester; and, if yea, in what capacity?

Ans. I am; as foreman.

Int. 3. How long have you been so employed there?

Ans. For the last eight years.

Int. 4. Has there been recently built in Mr. Crompton's mill at Worcester a Marshall open-shed fancy loom? If so, who superintended the building of it?

Ans. There has; I superintended the building of it myself.

Int. 5. By whose direction?

Ans. Mr. Crompton's.

Int. 6. About what time was that loom built?

Ans. We commenced it about two months ago, and finished it about four weeks from the commencement.

Int. 7. What directions did you receive from Mr. Crompton in regard to the loom you were to build?

Ans. To make it precisely like the specification and drawings of the Marshall patent—to make a Chinese copy of it, as he expressed it.

248 Int. 8. Have any goods been woven upon that loom since it was finished? If yea; how many pieces, and how many yards to a piece?

Ans. There have; four pieces; thirty-two yards to the piece as woven; they would measure less when finished, of course; they shrink in fulling.

Int. 9. Have you any of these pieces now present? If so, how many?

Ans. Yes; three pieces.

Int. 10. Where is the fourth piece?

Ans. It is now being finished at the mill in Worcester.

Int. 11. Which of the three pieces now present was the first piece woven in the loom?

Ans. That marked "Exhibit G—N. A. P., Ex'r."

Int. 12. Of what class or grade of goods is this piece?

Ans. What we call heavy goods. It is a "beaver," I should say.

Int. 13. Of what class or grade is the next piece which was woven in this loom, and which is that piece?

Ans. It is of medium weight, marked "Exhibit H—N. A. P., Ex'r."

Int. 14. Is the other piece which is here present similar in weight and pattern to that last mentioned?

Ans. It is, and is marked "Exhibit I—N. A. P., Ex'r."

Int. 15. In regard to the first two pieces mentioned, viz., "Exhibits G and H," how do they compare as regards the character of the pattern and the demand which the pattern makes in each case upon the open-shed peculiarity of the loom?

Ans. The one marked G, the heavy piece, would test the loom very thoroughly on account of the weight of the weaving. It is a simple pattern. The next one is a more complex pattern, and is a fair sample of that class of goods which requires complex patterns for weaving. It is a difficult piece to weave.

Int. 16. Which of the two pieces requires the greater number and variety of changes in shedding?

Ans. The last, Exhibit H.

Int. 17. At how many picks a minute has the Marshall loom above mentioned been run in weaving these pieces of goods?

249 Ans. Eighty-eight picks.

Int. 18. How does that compare with the average speed of narrow fancy looms of other constructions as they were run, say in the year 1850, if you know?

Ans. I don't know what the speed of them was at that time.

Int. 19. Have you ever had occasion in Mr. Crompton's mill to alter Thomas open-shed looms, so called, by substituting the Crompton pattern chain, so-called; that is to say, the chain having rolls on cross-rods for the Thomas pattern chain, so called; that is, the chain having leaves with perforations in them and two motions?

Ans. I have.

Int. 20. How long ago was this, and who gave the order?

Ans. It was about three years ago. The agent of the Beoli Mills gave the order.

Int. 21. How many looms were so altered for him?

Ans. Six.

Int. 22. What did you do to these six looms as regards the pattern mechanism?

Ans. I removed the pattern cylinder and the mechanism which operates it with the fingers which rests upon it which bear against the jack, and substituted the roller chain which bears directly upon the jack.

Int. 23. Do you mean that you took off the outer-weighted levers?

Ans. I do.

Int. 24. What was there in those Thomas looms to operate on the other side of the jack to throw them out from the side of the loom-weighted levers or springs?

(Objected to as leading.)

Ans. Weighted levers.

Int. 25. Did you leave those in the loom?

Ans. I did.

Int. 26. Did you have to do anything except to take off the outer-weighted levers and the Thomas chain and mount the Crompton roller chain?

250 Ans. I did not, with the exception of the method of turning the cylinder.

Int. 27. Did you move the cylinder which you put into these Thomas looms in the same manner that the cylinder was moved in the Crompton looms, having roller chains?

(Objected to as leading.)

Ans. I did.

Int. 28. How did the looms, when so altered, work?

Ans. They worked well—gave satisfaction.

Int. 29. Has there been, to your knowledge, any complaint or trouble about them since that time?

Ans. There has not.

Int. 30. What was the means, or method, of turning the cylinder which you used in applying the Crompton roller-chain to the Thomas looms?

Ans. It was a crank-pin on the end of the crank-shaft that gave motion to the connector, in the same manner in which it is moved in the Marshall loom.

And in answer to cross-interrogatories, propounded to him by George Gifford, esq., of counsel for respondent, deponent saith as follows, viz:

Cross-int. 1. What person or persons did you confer with, if any, respecting building the Marshall loom to which you have referred?

Ans. With no one but Mr. Crompton.

Cross-int. 2. Have you never talked with any other person about building that loom except Mr. Crompton; is that what you mean?

Ans. With no one, except the workmen who were employed upon it.

Cross-int. 3. How often did you confer or talk with Mr. Crompton upon that subject?

Ans. I don't think I conferred with him but a very few times; three or four times at the most, I think.

Cross-int. 4. Did you know of any other person talking with Mr. Crompton about the construction of that loom?

251 Ans. I did not.

Cross-int. 5. Has Mr. Crompton a shop or factory at Worcester where that loom was made?

Ans. He has.

Cross-int. 6. How long have you been in his employment?

Ans. About eight years.

Cross-int. 7. All the time at that place?

Ans. Yes, sir; all the time at his shop—his shop has been changed.

Cross-int. 8. What does Mr. Crompton manufacture in that shop?

Ans. Looms.

Cross-int. 9. How many men are employed in that establishment?

Ans. I should think there were two hundred at the present time.

Cross-int. 10. About how many men has been the average during the eight years you have been there?

Ans. I should think about one hundred and seventy-five.

Cross-int. 11. How long have you been foreman of the establishment?

Ans. All the time that I have been there.

Cross-int. 12. What kind of looms has Mr. Crompton manufactured in that establishment? Mention them all and their relative quantities.

Ans. Mostly looms for fancy cassimeres. Broad looms and narrow looms. We have built cam looms for blankets and flannels, and perhaps a very few for cotton goods. Tape looms for weaving narrow goods.

Cross-int. 13. Are those all the kinds of looms that have been made at that establishment since you have been there except the Marshall loom spoken of this morning?

Ans. It is all I remember. There have been some open-shed looms made. I had forgotten those.

Cross-int. 14. Have you now mentioned all the kinds?

Ans. That is all that I remember.

Cross-int. 15. About how many looms in all have been made in that establishment on an average per year since you have been there?

Ans. Perhaps one thousand a year.

252 Cross-int. 16. About what proportion of those have been the cassimere looms?

Ans. About three-quarters.

Cross-int. 17. About what proportion of them have been cam looms for blankets, etc.?

Ans. It's impossible to give the exact proportion; about an equal number of each of the others, except those for cotton—the cam loom, tape loom, and open-shed loom.

Cross-int. 18. Have any been made which were known as fancy looms?

Ans. All of these were fancy looms except the cam looms.

Cross-int. 19. Were the cassimere looms, the cam looms, and the tape looms open-shed looms?

Ans. Those that I designated as such were not open-shed looms. The open-shed looms I have mentioned were, however, in fact, cassimere looms.

Cross-int. 20. What do you mean by an open-shed loom?

Ans. I mean a loom that holds the harnesses and the warp contained

in them in one shed, till it is required by the pattern to be moved into the opposite shed.

Cross int. 21. Is not that the case with the cam looms?

Ans. It is, but the cam looms are designated by that title, and the open-shed looms are fancy looms, with that peculiarity of moving the warp from one shed to the other.

Cross-int. 22. Have there not been any close-shed fancy looms made at that factory since you have been there?

Ans. There have. I stated that before.

Cross-int. 23. Has there been any Marshall loom or looms made at that factory since you have been there, except the one which you say you superintended the construction of?

Ans. There has been no loom made precisely like the Marshall loom except that one.

Cross-int. 24. Have there been any made substantially like it except that one?

(Objected to.)

253 Ans. There have been looms made so far like it that they were open-shed fancy looms. There was no peculiarity of the lifter and depresser like it.

Cross-int. 25. When were these open-shed fancy looms referred to in your last answer made?

Ans. I can't give the precise time. I should think somewhere in 1859, '60, or '61; somewhere along there.

Cross-int. 26. About how many of them, according to your recollection, were made?

Ans. I should think there might be from seventy-five to one hundred. There may have been a good many more; I could not tell about that now; I've nothing to do with the counting-room.

Cross-int. 27. Under whose patent, if any one's, did you understand, at the time, they were made?

Ans. Under Mr. Geo. Crompton's patent.

Cross-int. 28. For whom were they made?

Ans. Different parties had them. Mr. Barrows, of Dedham, had some. I don't recall the names of other parties now.

Cross-int. 29. What was the name of the company at Dedham with which Mr. Barrows was connected, if any?

Ans. I think it was by the name of Thomas Barrows that they were sent.

Cross-int. 30. Was there a company at Dedham with which Thos. Barrows was connected at the time?

Ans. I am not aware that there was.

Cross-int. 31. Do you remember the date or about the date of the letters patent to Geo. Crompton under which these open-shed fancy looms were made?

Ans. I do not.

Cross-int. 32. Specify all the particulars in which the open-shed fancy looms referred to in the answer to 24th cross-interrogatory differed from the Marshall loom that you say you recently constructed at Worcester.

Ans. The difference was principally in the lifter and depresser, which in the Marshall loom has a continuous movement, and in those which we built had a reciprocating angular movement. Those had no 254 evener. These are all the points except the difference in style of the frame and parts which carried the work.

Cross-int. 33. Do you know whether or not there are any of those open-shed fancy looms in use now; and if yea, where?

Ans. I do. They are in use at Mr. Barrow's mill in Dedham, and at another mill there, the name of which I do not know now. They were sent to other places, and are, I presume, used there now; but I don't know.

Cross-int. 34. I understand you to say that one difference was that in the Marshall loom the lifter and depresser had a continuous motion; you mean by that that it had a rotary motion, do you?

Ans. I do.

Cross-int. 35. And in those open-shed fancy looms which were constructed in Crompton's shop, the lifter and depresser reciprocated up and down, did it not?

Ans. It did.

Cross-int. 36. You say the other difference was that those made at Mr. Crompton's shop had no eveners. Do those two differences—that is, the difference in the movement of the lifters and depressers, and the absence of eveners in those built in Mr. Crompton's shop—constitute the only differences between those built in Mr. Crompton's shop and the Marshall loom?

Ans. I should say that was all the essential difference. The parts were made to conform in shape to these changed parts which were different.

Cross-int. 37. I asked you to specify all differences, and now again request you to do so, without first attempting to discriminate between those that are essential and those that are non-essential in your opinion.

Ans. Well, we connected the jack to the top lever in an improved manner to what that was in the Marshall loom. The jack was altered in shape to conform to the lifter and depresser. There were other smaller differences of thickness of castings of one-sixteenth thicker or thinner, or there might have been; I don't recollect exactly about
255 that; I've no means of recalling it. Those are all the differences that I can recall.

Cross-int. 38. In those Crompton open-shed fancy looms, were the jacks of the same shape as the jacks in the Marshall loom?

Ans. They were made to conform to the movements of the lifter and depresser, as I have stated.

Cross-int. 39. 38th cross-interrogatory repeated.

Ans. They were not.

Cross-int. 40. In those Crompton open-shed fancy looms, what held the jacks up and down?

Ans. There is one latch which held them up, and one that held them down.

Cross-int. 41. In what way did the latch hold the jacks up? Specify particularly.

Ans. There was a hook in the jacks, which, as it ascended, pushed the latch back, and when the hook moved above the latch it sprung in below it and held it.

Cross-int. 42. You say that there were no eveners on the Crompton open-shed fancy loom; was there any means of holding or evening the jacks except the lifter and depresser and latches you have spoken of?

Ans. There was nothing. I don't see as the lifter and depresser would aid in evening them; all they do is to move them from one shed to the other.

Cross-int. 43. In those Crompton open-shed fancy looms, what was relied upon to hold and even the jacks?

Ans. The latches.

Cross-int. 44. Do you not recollect to whom any of those looms were shipped, addressed, or sent, excepting T. Barrows?

Ans. I do not. Some were sent to Canada, Connecticut, Rhode Island, and New York State, but I don't remember the places.

Cross-int. 45. When was the last of those looms made?

Ans. Some four or five years ago, I should think.

Cross-int. 46. Were all those Crompton open-shed fancy looms made alike?

256 Ans. I think they were, all that I had the superintendence of, except that some were broad and some were narrow.

Cross-int. 47. Did you superintend the construction of all of them?

Ans. I did not.

Cross-int. 48. What portion of them did you superintend the construction of, and who superintended the construction of the rest?

Ans. I do not know how many were constructed before I went to work for Mr. Crompton, nor who superintended the construction of them, and cannot tell what portion I superintended.

Cross-int. 49. Do you recollect that one or more of them was sent to the Washington Mills in Lawrence, Mass.?

Ans. I do now recollect that one or more was sent there. I don't know the number.

Cross-int. 50. In your direct examination you stated that you had substituted a different pattern mechanism, that is, with rolls in place of the Thomas pattern mechanism, in the Thomas loom. I wish you to state in detail what you did in making such substitution, including every piece or thing which you removed from the Thomas loom, and every piece or thing which you introduced into it.

Ans. I removed the pattern cylinder and its chain, its hook for turning the cylinder around, the slide rod to which the cylinder is connected with the bell lever which moves the pattern mechanism up and down, the cam which operates the bell lever, also the weighted levers through which the indication is conveyed to the jacks from the pattern chain. That includes everything which operates the chain cylinder, and everything which I took off. I applied a roller-chain cylinder and chain directly to the jacks, where the chain would give the proper movement to the jacks. With the cylinder I applied a ratchet-wheel hook, quadrant-shaped lever, two connectors to move the hook. One connector went to a lever, and the other from the opposite end of that lever to the end of the crank shaft. Upon the end of the crank shaft was put a plate with a crank pin, into which the connector was attached to operate the cylinder.

Cross-int. 51. What did the ratchet-wheel do which you applied?

Ans. The ratchet-wheel was for the hook to turn the cylinder
257 to bring the bars of the pattern chain into operation consecutively. It was attached to the shaft of the cylinder.

Cross-int. 52. Why was the lever quadrant-shaped?

Ans. Because the hook which turned the cylinder was attached to one part of it, and the connector that gave motion to the hook was attached to another part about one-fourth the distance round.

(Defendant's counsel here puts in evidence certified copy of letters patent granted to Geo. Crompton, April 27th, 1858, for improvement in looms which is marked defendant's Exhibit "No. 6, N. A. P., Ex'r.")

Cross-int. 53. Look at defendant's Exhibit No. 6, and state whether or not the latches for holding the jacks in the Crompton open-shed fancy looms, which you say you superintended the construction of, were operated as described in that "Exhibit 6."

Ans. They were not.

Cross-int. 54. State wherein they differed as to the means of operating them.

Ans. They were operated with a spring applied directly to the back of the lower latch on most of them. Some looms had the spring applied in the manner stated, and an additional spring applied to the upper latch to draw it in, and in this case the upper latch and lower latch were independent of each other—separate. The latches were applied on the opposite side of the jack to what they are in this exhibit—that is, reversed from what they are in the drawing.

Cross-int. 55. I understand you to say there were only two latches for all the jacks. Is that so?

Ans. It is.

Cross-int. 56. Which side of the jack was the pattern chain in those Crompton open-shed fancy looms?

Ans. On the outside, the same as in the Marshall loom.

And in answer to direct interrogatories resumed by Causten Browne, esq., deponent saith as follows, viz:

258 Int. 31. Was there in these Crompton open-shed fancy looms a bar hinged to the lifter and one to the depresser?

Ans. There were.

Int. 32. Please describe the operation of these bars and their purpose in the loom.

Ans. I will describe the one attached to the lifter (the one attached to the depresser has the same operation). This bar was hinged to the lower side of the lifter and projected about two inches below the lifter. This bar was kept pressed towards the jacks by a spring on the back of the bar. When the lifter was in the proper position to leave the jacks distributed by the evolution of the chain, those jacks that were brought over the lifter to be elevated came on to the lifter. Just below the lifter on the jack was a shoulder or catch, whichthis hinged bar took into and was prevented from running away from the lifter. That kept the jack from running away from the lifter, in contact with the lifter, till it moved to the centre of the shed, when there was no occasion for its action any longer. The same operation was performed with the depresser by similar means.

Int. 33. You have said in one of your answers on cross-examination that the Crompton open-shed looms were built under the patent of George Crompton. Please explain your meaning.

Ans. I stated so because I had no knowledge of the Marshall loom at that time, and supposed it was Mr. Crompton's that we were building the looms under.

Int. 34. You said in one of your answers on cross-examination that during the building of the Marshall open-shed loom you "conferred" from time to time with the workmen employed upon the loom. Explain what you mean by that.

Ans. I mean that I gave them instructions to build it; in that sense I used the word.

Int. 35. You also said that you conferred several times with Mr. Crompton during the building of the loom. Explain what you mean by that.

Ans. I mean that Mr. Crompton and I examined the progress of the work on the loom.

259 And in answer to cross-interrogatories resumed by George Gifford, esq., deponent saith as follows:

Cross-int. 57. When did you first commence work for Mr. Crompton?

Ans. I feel very confident that it was in 1859.

Cross-int. 58. Are you sure that it was in 1859?

Ans. I am sure that it was in 1859.

Cross-int. 59. What season of the year was it when you commenced?

Ans. It was in the winter.

Cross-int 60. I understand you to say that they were making the Crompton open-shed fancy looms there when you commenced. Is that so?

Ans. Yes, sir.

HORACE WYMAN.

Deposition of D. M. Downes, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 13, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. D. M. Downes; age, 27; residence, Olneyville, North Providence, R. I.; occupation, superintendent of the Riverside Mills—fancy woollen mills.

Int. 2. How long have you been such superintendent?

Ans. Two years the 1st of last August.

Int. 3. How were you employed before you went into that mill?

Ans. In learning practically the woollen business.

Int. 4. Were you ever a practical weaver; if so, how long, including the time of your apprenticeship?

Ans. I was for about two years, I should judge. I served one year in keeping looms in order—fixing looms. I learned to weave, and wove about one year at different times before that.

260 Int. 5. How many looms do you have, and how many hands do you employ, at the Riverside Mills?

Ans. We have forty looms, but run on an average about thirty broad looms; we employ about one hundred and fifty hands, I should judge.

Int. 6. Have you ever had in your mill, during your superintendency, any Thomas open-shed fancy looms, so called?

Ans. We had thirty.

Int. 7. Were they procured before or after you became superintendent?

Ans. Before.

Int. 8. State, if you know, about when they were procured, and about how long they continued to be used there?

Ans. I don't remember when they were bought; but I was engaged in the first place to oversee the weaving, and started the first loom myself about the last of June, 1864. They continued in use until the fall of the next year, 1865.

Int. 9. Generally speaking, how was the operation of these Thomas open-shed fancy looms, satisfactory or unsatisfactory?

Ans. Unsatisfactory.

Int. 10. How was it as to the action of the back weights to shift the jacks? Was there any difficulty in that respect; and, if any, what was done to remedy it?

Ans. The action was uncertain. You couldn't depend upon it. In the first place, to remedy it, we applied a spring under the back weight fastened to the iron cross-piece underneath to pull the weight down and make it act more quickly; that did not work. We then had weights made, with an ear attached with a groove in it, to do away with the back weights entirely. The jack rested in the groove. I produce a pattern of one of the weights so altered. It is marked "Exhibit K—N. A. P., Ex'r." If the chain did not work promptly, or the wire did not drop into

the hole in the chain, the piece in the back of the jack was broken off. I mean the grooved ear. To remedy that we used a spring attached to the grooved ear, so that if the wire caught, the spring would give and prevent the ear from being broken off.

261 Int. 11. Have you here present a weighted back-lever, and grooved ear, and spring, as you have just described it? If so, will you produce them?

Ans. I have; I produce them herewith—the weighted lever being marked "Exhibit L—N. A. P., Ex'r," and the grooved ear with spring attached being marked "Exhibit M—N. A. P., Ex'r."

Int. 12. How was it as to these Thomas looms missing picks?

Ans. We had a good deal of trouble in that respect.

Int. 13. What were the causes of their missing picks?

Ans. We laid it to the friction in the uprights, causing one to carry another with it; also to the weights not acting quickly enough.

Int. 14. What do you mean by the uprights?

Ans. We call them jacks or levers.

Int. 15. What were the adjacent parts, which made the friction against one another, of which you speak?

Ans. I don't know the name of it; the part of the gear which raises the jacks.

Int. 16. Did the working of the pattern chain have anything to do with missing picks? If so, how?

Ans. It did by the buttons becoming loose and moving from their places.

Int. 17. What did you do to prevent the sector from carrying its next-door neighbor with it by friction?

Ans. In some cases we made heavier springs and put on the brakes.

Int. 18. Was there any trouble, and, if any, what, about these friction brakes?

Ans. If we kept them perfectly clean, they worked well; if we got any oil under them, they troubled us.

Int. 19. How was it in regard to the shuttle-box motion of the loom?

Ans. On simple patterns, it worked well; on complicated patterns, the weavers couldn't manage it.

Int. 20. What was the effect of the difficulties you have mentioned about these looms as to the expense of fixers, or persons to keep the looms in order?

262 Ans. To get good fixers we were obliged to pay more than to fixers on other kinds of looms.

Int. 21. What was the effect of these difficulties as to getting and keeping weavers to run the looms?

Ans. It was impossible to keep good weavers upon those looms.

Int. 22. Why?

Ans. Because the looms run so badly that they could not make good pay or good work.

Int. 23. What did you finally do with these Thomas looms?

Ans. We sold them.

Int. 24. State, as nearly as you can, what they cost you, and what you sold them for.

Ans. I am not positive either as to the cost or what the looms were sold for.

Int. 25. State your best recollection as to this.

Ans. I think they cost $45,000 each, and were sold for $30,000.

Int. 26. What looms did you put in their place in the mill?

Ans. The Crompton upright jack broad looms.

And in answer to cross-interrogatories by Geo. Gifford, esq., of counsel for respondents, deponent saith as follows, viz:

Cross-int. 1. What looms are you now using in your mills, the open-shed or close-shed?

Ans. The close-shed.

Cross-int. 2. Of whom did you procure them?

Ans. Of Geo. Crompton.

Cross-int. 3. To whom did you sell what you call the Thomas looms?

Ans. I think to the Glendale Woollen Co. of Fishkill, Duchess County, New York; Wm. Dart, treasurer.

Cross-int. 4. You have mentioned alterations that were made in some parts of the Thomas looms; who made these alterations for you?

Ans. I can't name the persons; they were fixers employed by me.

263 Cross-int. 5. Did not Thomas make any alterations, or cause any to be made for you?

Ans. I think he did.

Cross-int. 6. Do you remember what the alterations were which he made?

Ans. I think he sent us the weights with the springs on the ears on the backs of them.

Cross-int. 7. Were those on the looms when you sold them?

Ans. They were partly.

Cross-int. 8. When did you procure the looms of Mr. Crompton, which you have now in use?

Ans. At different times; I don't remember when the first looms were received; but in the fall of '65, I think. The last were received, I think, some time in the spring of 1866.

And in answer to direct interrogatories resumed by Causten Browne, esq., deponent saith:

Int. 27. Did you try any other looms after condemning the Thomas looms and before purchasing the Crompton?

Ans. I did; the Greenhalgh loom made by the Woonsocket Furnace Co.; also the old pattern Crompton loom.

Int. 28. After encountering the difficulties you have mentioned, did you send for Mr. Thomas to come to your mill; and, if so, for what purpose?

Ans. I think Mr. Thomas was sent for once, and I don't know but more—I am not certain—to see if he could do anything to improve the working of them.

Int. 29. Did he come?

Ans. I think he did.

Int. 30. Did he attempt to remove the difficulties? If so, with what success?

Ans. I think it was after he came to see us that he sent the weights with springs, and also some double scroll cams to take the place of weights in working the harness motion; I mean the heavy weights which were in the lower part of the loom.

264 And in answer to cross-interrogatories resumed by G. Gifford, esq., deponent saith:

Cross-int. 9. Were you superintendent at these mills at the time the Thomas looms were purchased or ordered?

Ans. I was not.

Cross-int. 10. Are you aware that the party who was then in charge

requested that those looms be built with some peculiarities suggested by himself?

(Objected to.)

Ans. At what time?

Cross-int. 11. At about the time they were ordered, or while they were being constructed.

Ans. I was not.

D. M. DOWNES.

Deposition of George Crompton, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 13, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. George Crompton; age, 37; residence, Worcester, Mass.; manufacturer of machinery.

Int. 2. Was the Marshall open-shed loom which has been lately built in your factory at Worcester built by Mr. Wyman by your direction?

Ans. It was.

Int. 3. What directions did you give him?

Ans. I gave him directions to make an exact, and, I think I expressed it, a Chinese copy of the specifications and drawings of Moses Marshall's reissue patent.

Int. 4. When you contrived your open-shed fancy loom in or about 1859, did you know of the existence of the Marshall open-shed loom patent?

Ans. I did not.

265 Int. 5. Or of the loom itself?

Ans. I did not know of the existence of such a loom or of such a patent; neither did I know anything about Mr. Thomas's loom even at that period.

Int. 6. Has the manufacture of the Thomas open-shed fancy looms since 1860 or 1861 affected injuriously your own manufacture of your open-shed fancy looms? If so, in what manner?

Ans. It has affected the sale of my open-shed looms and of some close-shed looms, by being very largely introduced about 1860 into some of the most prominent mills in the New England States; which looms, operating during the war upon a low number of harnesses, on army goods, &c., did not really show its character as a fancy loom, until recently, upon an extended scale.

Int. 7. How does the presence of Mr. Thomas in the loom-building business as a competitor effect the prices which you are able to ask and to get for your own open-shed fancy looms?

Ans. Naturally it keeps the prices down.

And in answer to cross-interrogatories propounded to him by George Gifford, esq., of counsel for respondents, deponent saith as follows, viz:

Cross-int. 1. You say at the time you contrived your open-shed fancy loom you did not know of the Marshall loom or of the Marshall patent. When did you first hear of the Marshall loom or patent?

Ans. I could not say with any certainty how soon after I contrived and had built an open-shed loom I did discover Marshall's patent.

Cross-int. 2. In what way did it first come to your attention or knowledge?

Ans. Quite accidentally; looking through the Patent Office reports.

Cross-int. 3. Was that before or after you applied for your patent?

Ans. I do not remember; it is so long ago.

Cross-int. 4. When did you contrive your open-shed fancy-loom?

266 Ans. I first conceived the idea in 1856, and made some experiments. I continued these experiments through '56 and '57 until I had made a loom substantially like the drawings in the patent issued to me April 27, 1858.

Cross-int. 5. Did you purchase, or contract for the purchase, of the Marshall patent before you applied for your patent?

Ans. I don't remember; but my impression is that it was afterwards.

Cross-int. 6. What price did you pay for the Marshall patent?

(Objected to, and the witness is advised by his counsel that he is not bound to answer that question.)

Ans. I decline to answer the question, by the advice of my counsel.

Cross-int. 7. Did you purchase the Marshall patent before it was extended?

Ans. I decline to answer that question also.

Cross-int. 8. Why do you decline to answer that question?

Ans. Because I think it is my private business.

Cross-int. 9. Has the Marshall patent cost you as much as three hundred dollars?

(Objected to, and counsel for complainant advises deponent that he is not bound to answer the question.)

Ans. I decline to answer the question.

Cross-int. 10. Have you paid Marshall as much as three hundred dollars for your interest in that patent?

(Objected to, and advice as before.)

Ans. I have before stated that it is my private business, and decline to reply.

Cross-int. 11. Did you purchase or procure an interest in the Marshall patent to better enable you to compete with others in the manufacture and sale of open-shed fancy looms?

(Objected to, and advice as before.)

Ans. I decline to reply.

Cross-int. 12. Did you purchase or procure an interest in the Marshall patent to better enable you to compete with Mr. Thomas in the manufacture and sale of open-shed fancy looms?

267 (Objection and advice as before.)

Ans. I decline to answer.

Adjourned to Thursday, 14th inst., at 9½ a. m.

FEB. 14.

Cross-examination resumed.

Cross-int. 13. How soon after you had procured an interest in the Marshall patent did you notify, or cause to be notified, parties that they were infringing it?

Ans. In October, '60, certain parties using the Thomas loom were notified that they were infringing the Marshall patent.

Cross-int. 14. At the time you made the purchase from Mr. Marshall, or while you were negotiating for it, was it not understood between you that one of his reasons for selling to you was because he was not able to introduce his loom into use in opposition to the competition which he had to encounter?

(Objected to, and the witness is advised by his counsel that the question is not proper on cross-examination, and that he is not bound to answer it.)

Ans. I decline to answer.

Cross-int. 15. Does any instrument, assignment, or agreement, in writing, from Mr. Marshall to you, or between you and Mr. Marshall, contain the date of your purchase of him of his patent, or an interest therein?

(Objection and advice as above.)

Ans. I decline to answer.

Cross-int. 16. Does any such assignment or agreement show the consideration for which you made such purchase?

(Objection and advice as before.)

Ans. I decline to answer.

Cross-int. 17. At the time you made such purchase of Marshall, or while you were negotiating concerning it, was it or not understood between you that a part of the consideration to Marshall was to be your services, influence, and efficiency in introducing the loom into use?

(Objection and advice as before.)

Ans. I decline to answer.

(The defendants' counsel here demands the production of the
268 deed or agreement between Moses Marshall and the complainant, George Crompton, dated May 5th, 1859, and of which profert is made in the bill of complaint in this suit on the 6th page of the printed record, to enable them to properly proceed with the cross-examination of this witness, and also for other purposes in proceeding with their defence.

Complainant's counsel says that he has no answer to make.)

Cross-int. 18. What was your object or motive in purchasing the Marshall patent, or an interest therein?

(Objection and advice as before.)

Ans. I decline to answer.

Cross-int. 19. Did you not, before you purchased the Marshall patent, or any interest therein, know of open-shed fancy looms being in use or made?

Ans. I did.

Cross-int. 20. Where were such looms in use, which you knew of?

Ans. At Lawrence.

Cross-int. 21. In what mill or mills at Lawrence?

Ans. The Pemberton Mills.

Cross-int. 22. Did you at that time know, or were you informed, who manufactured and sold those looms?

Ans. I did.

Cross-int. 23. Who was it?

Ans. Mr. Thomas, or his agent.

Cross-int. 24. Do you mean Samuel T. Thomas?

Ans. Yes.

Cross-int. 25. Did you see those looms at the Pemberton Mills at Lawrence?

Ans. I did.

Cross-int. 26. How many were there there in operation?

Ans. I do not remember.

Cross-int. 27. Did you know, or were you informed, where said Thomas manufactured those looms?

Ans. I don't remember; it was so long ago.

269 Cross-int. 28. At the time you saw those Thomas looms at the Pemberton Mills, had you sold any open-shed fancy looms; and if yea, to whom, and where?

Ans. I had not sold any.

Cross-int. 29. Did you or not, prior to the purchase of the Marshall pat-

ent, or an interest therein, know of any open-shed fancy looms being in use, except those manufactured by said Thomas?

Ans. No.

Cross-int. 30. Did you at that time know of any open-shed fancy looms being in use, except those at the Pemberton Mills in Lawrence?

Ans. I don't remember of any others.

Cross-int. 31. At what date was it when you first saw those Thomas looms at the Pemberton Mills?

Ans. I don't remember what time it was.

Cross-int. 32. Did you see them there more than once?

Ans. I only remember seeing them once at the Pemberton Mills.

Cross-int. 33. Do you remember in what year that was?

Ans. I do not.

Cross-int. 34. How many open-shed fancy looms have you made and sold?

Ans. Without my books I could not give a correct answer.

Cross-int. 35. Answer according to your best recollection.

Ans. Fifty or sixty would include all I made of the open-shed.

Cross-int. 36. When did you sell the first of them, and to whom?

(Counsel for complainant, at this point, in view of the general character of the cross-examination, and its being conducted without regard to the limits of the examination-in-chief, and in view of the fact that the examiner has no power to check such cross-examination, withdraws the witness from the stand. Witness here leaves the stand.

Counsel for defendants objects, first, to this extraordinary, illegal, and unauthorized interruption of the complainant's counsel; second, to the witness leaving the stand, and he insists that complainant's
270 counsel has no right or power to withdraw a witness under the present circumstances. And defendants' counsel further objects to the complainant's counsel introducing any other or further evidence, or examining any other witness on the part of complainant in this suit, or proceeding any farther in the prosecution of this suit, until the cross-examination of the witness and party, George Crompton, has been finished; and counsel for defendants will object to the use of, and insists upon having ruled out, any evidence which shall be hereafter taken on the part of complainant in this suit, before the cross-examination of the party and witness, George Crompton, be completed.

Mr. Crompton recalled by complainant's counsel after depositions of Jas. Cook and Thos. Barrows were given.)

FEB. 14, *p. m.*

Cross-examination resumed by Mr. Gifford:

Ans. I don't remember.

Cross-int. 37. State as nearly as you can remember.

Ans. I think the first loom I sent out was a broad loom, to the Washington Mills, Lawrence, Mass.; but I am not certain. It was in 1860, I think, but I am not certain. I am speaking without minutes, and the question was not expected.

Cross-int. 38. Did you afterwards furnish other open-shed fancy looms to the Washington Mills; and, if yea, were they broad or narrow ones? And state as nearly as you can when you furnished them?

Ans I only furnished one broad loom to that mill, the one before referred to. I also furnished two narrow ones, but cannot remember whether these were close or open shed looms. I think the narrow looms were sent some time after the broad loom. I couldn't state exactly.

Cross-int. 39. To whom did you sell the last open-shed fancy looms which you sold?

Ans. To Thomas Barrows, of Dedham.

Cross int. 40. To how many different parties have you sold open-shed fancy looms?

Ans. I could not answer that question without my books.

271 Cross-int. 41. State as nearly as you can remember.

Ans. I couldn't state any precise number. I sent sample looms of the open shed to different parties.

Cross-int 42. Have you sold the open-shed fancy looms to as many as four different parties?

Ans. I probably have.

Cross-int. 43. Are you sure you have?

Ans. As I said before, I am sure of nothing without reference to my books on the subject.

Cross-int. 44. According to your best recollection, have you or not sold open-shed fancy looms to as many as ten different parties?

Ans. I've no recollection of the number.

Cross-int. 45. According to your best recollection, have you not sold the open-shed fancy looms to as many as three different parties?

Ans. Yes.

Cross-int. 46. Well, then, can you not state whether or not, according to your best recollection, you have sold open-shed fancy looms to as many as ten different parties?

Ans. I have already stated that I sold one to the Washington Mills, and some to Mr. Barrows, and a number were sold to the Maverick Mills. I don't remember the names of all the parties I sent them to besides.

Cross-int. 47. You say that you sent sample open-shed fancy looms to different parties. To whom did you send them?

Ans. I don't remember the parties I sent them to. I only remember one other party besides those I have mentioned, and that is Edward Harris, of Woonsocket.

Cross-int. 48. Do you not remember even one more?

Ans. It was so long ago I should want some time to think upon the matter.

Cross-int. 49. Please take time to think, and then give us the best of your recollection; and state, if you please, how much time you need.

Ans. It would take till to-morrow morning; till I get my books.

(The defendants' counsel suggest to the complainant's counsel,
272 for the purpose of getting at the facts, and of avoiding mistakes, that the cross-examination of Mr. Crompton be suspended by consent until to-morrow morning, so that he can get his books. To which suggestion counsel for the complainant assents.)

Adjourned to to-morrow, Friday 15th, at 9.30 a. m.

FRIDAY, *Feb.* 15.

Cross-examination resumed:

Cross-int. 50. Have you consulted your books since the adjournment of your examination yesterday?

Ans. I have.

Cross-int. 51. Please state, if you can, how many open-shed fancy looms you have sold, to whom, and where, and when.

Ans. The first one I made was sold in 1859 to Fox & Co., Worcester, Mass. It was a narrow loom. The next was a broad loom, altered from

the old Crompton loom, for the Washington Mills. Then sales of looms as follows:

Nov., 1859,	Hockanum Co., Rockville, Conn.,	2	broad looms.
Dec., 1859,	Maverick Mills, Dedham,	2	narrow "
Feb., 1860,	Mohawk Mills, Little Falls, N. Y.,	4	broad "
Mar. and May, 1860.,	S. L. Hodges, Worcester,	8	" "
June, 1860,	Utica Steam Woollen Co., Utica, N. Y.	6	narrow "
" "	Merrimac Co., Lowell, Mass,	6	" "
July, "	Peacedale Manufacturing Co., Peacedale, R.I.,	1	broad loom.
Sept., 1860,	Edward Harris, Woonsocket, R. I.,	5	narrow looms.
Dec., "	" "	5	" "
Oct., "	S. W. Baker, Providence, R. I.,	1	narrow loom.
Nov., "	J. Thompson, Galt, C. E.,	1	" "
Nov., 1862,	Maverick Woollen Co., Dedham, Mass.,	38	broad looms.
June, 1864,	Thomas Barrows, Dedham, Mass.,	16	broad looms.
Nov., "	Merrimac Woollen Co., Lowell, Mass.,	6	" "
Dec., "	" " " " "	7	" "

Being 27 narrow, and 83 broad looms.

273 Cross-int. 52. Were those looms all made alike with reference to the parts and combination of parts?

Ans. They were.

Cross-int. 53. What means did you use, or measures did you take, to procure sales for said open-shed fancy looms?

Ans. I called the attention of manufacturers to the loom as I would to any new improvements. I called the attention of all the customers who visited me to an open-shed loom of my make in a neighboring mill, and issued wood-cuts illustrating it.

And in answer to direct interrogatories resumed by Causten Browne, esq., deponent saith as follows, viz:

Int. 8. Have you altered any of your open-shed looms mentioned in your list above given, since delivering them to the purchasers? If so, about how many have you so altered, and into what loom have you altered them?

Ans. I have altered a number of them, thirty-two in all, into the old Crompton harness motion, close-shed.

Int. 9. Have you altered any Thomas open-shed looms for parties who had purchased them from him? If so, how many, and into what kind of loom did you alter them?

Ans. I was desired by the Manchester Print Works, of Manchester, N. H., to alter two narrow Thomas open-shed fancy looms into old Crompton close-shed looms, and did so in March, 1863.

Int. 10. What fault was found with your open-shed fancy looms by parties for whom you so altered them?

Ans. Some liked the open shed for a time, but finally thought it disadvantageous in principle; others could not see much difference; but having a large number of close-shed looms, and but few open-shed, thought it better to change them into close-shed, and have them all alike.

Int. 11. You say that some thought the open-shed disadvantageous in principle. Do you mean the principle of your open-shed fancy looms or do you mean the principle or method of open-shed weaving?

Ans. I mean the principle of open-shed weaving.

274 Int. 12. What was the objection made to that?

Ans. It was claimed that in some patterns the filling would come up through the cloth in kinks and make its surface rough, which was considered very objectionable.

Int. 13. Were the patterns, with which this occurred, patterns in which one shade required to be held up or down a very long time?

Ans. There was another objection in such a case as that from slackening the warp threads too much.

Int. 14. Will you explain fully how these two objections you have mentioned grow out of the open-shed method of weaving?

Ans. The kinking of the filling was produced, I understood, by its remaining loose in the shed until struck home by the reed to the fell of the cloth, and projected the kinks through the warp threads, thereby producing a rough surface on the cloth. The other objection was holding a harness up or down for a considerable time, and beating up the filling against the said harness, causing a strain which tended to lengthen the warp yarn; and this also tended to make the cloth rough.

Int. 15. If I understand you, the effect of having a warp thread or shade held up or down a considerable time is to leave it relatively longer than those warp threads which have been shedded and interlocked, causing such first-named warp thread or shade to be looser than it should be in the cloth. Is that so?

Ans. It is.

Int. 16. Was any difficulty found, or complaint made, by your open-shed loom customers as to the mechanical construction of your open-shed loom?

Ans. Nothing but what is incidental to all comparatively new machinery.

Int. 17. Such as what?

Ans. I know of nothing but what grew out of a lack of knowledge of such character of loom.

Int. 18. After the purchasers or their employees became familiar with the use of your open-shed fancy looms, was any complaint made, or difficulty found, as to their mechanical construction?

(Objected to.)

275 Ans. There was not.

Int. 19. As to those of your open-shed fancy looms which were not altered as above mentioned, have they been in regular operation or not since they were furnished by you, so far as you know?

Ans. So far as I know, they have.

Int. 20. How frequently in ordinary fancy loom weaving is a pattern called for of such a kind as to require a warp thread to be held up or down so long as to involve the embarrassment or objection you mentioned above?

Ans. I cannot answer definitely, but it occurs frequently; in some mills more than others.

Int. 21. Has Mr. Thomas, to your knowledge, been a manufacturer of any other looms than his open-shed fancy looms since they were introduced?

Ans. He has not, to the best of my knowledge.

Int. 22. Why did not the use of the Thomas fancy looms, operating during the war upon a low number of harnesses, upon army goods, &c., really show its character as a fancy loom?

Ans. Because it was not desirable to use so many harnesses, and extensive patterns do require a large number of harnesses, and more thoroughly test the efficiency of the apparatus for operating the shed.

Int. 23. By extensive pattern do you mean variegated pattern?

Ans. I mean the capacity of the harness motion in arranging the warp threads to form the figure.

Int. 24. Is this capacity the more fully tested the more variegated or diversified the figure to be woven is?

Ans. It is.

Int. 25. From your knowledge of the operations of mills in this part of the country, since the termination of the war, has the demand for the Thomas open-shed fancy looms continued or fallen off?

Ans. It has fallen off, I think.

Int. 26. Have you found it to your interest to manufacture your open-shed fancy looms against the competition of the Thomas open-shed fancy looms?

Ans. I have not.

Int. 27. How did the profit which you were able to make upon
276 your open-shed fancy looms, with Mr. Thomas bidding against you, compare with the profit which you were able to make upon your other patented looms, your exclusive right to which was respected?

Ans. It compared very favorably with the latter loom. I made the most profit on the close-shed loom. That is what I mean to say.

And in answer to cross-interrogatories resumed by George Gifford, esq., deponent saith as follows, to wit:

Cross-int. 54. Which of the open-shed fancy looms which you have referred to in your answer to the 51st cross-interrogatory did you alter to the old Crompton close-shed looms, and when did you make such alterations of those looms respectively?

Ans. The first looms I altered were those of the Hockanum Co., Rockville, Conn., two broad looms, in the early part of 1860. The Mohawk Mills, four broad looms, in the latter part of 1860. Hodges, Worcester, eight broad looms, in 1861, Utica Steam Woollen Co., six narrow looms, probably in 1861. Edward Harris, Woonsocket, R. I., ten narrow looms, in 1861. Thompson, of Galt, C. E., one narrow loom, in 1862.

Cross-int. 55. You say that some of those parties thought the open-shed weaving disadvantageous in principle. Which of those parties so thought?

Ans. Mr. Edward Harris and the Mohawk Mills thought so.

Cross-int. 56. Which of the parties for whom you altered the looms thought there was not much, if any, difference between the open-shed and the close-shed weaving, but having more of the close-sheds thought they would have them all alike, and therefore had their open-sheds altered to the old Crompton close-sheds?

Ans. Fox & Co., of Worcester, Mass.; Hockanum Co., Rockville, Conn,; Hodges, of Worcester; Utica Steam Woollen Co., Utica, N. Y.; and Thompson, of Galt, C. E.

Cross-int. 57. Did you receive pay for making the alterations in those looms, or did you sell them on condition that if they were not satisfactory you would alter them without any pay in addition to the original price?

277 Ans. I sold them without conditions, and for some looms altered received pay. For others I changed them gratuitously.

Cross-int. 58. For which did you receive pay, and which did you alter gratuitously, and why did you make that distinction?

Ans. I changed gratuitously those of Hodges, the Mohawk Mills, and Edward Harris. For the remainder I think I received pay. The parties I have named, excepting Mr. Harris, said they had no claim upon me,

but induced me to change them. Mr. Harris said he had no claim, but ordered them changed, and I never made any demand upon him.

Cross-int. 59. You stated in your re-direct examination that, after the purchasers or their employees became familiar with the use of your open-shed fancy looms, there was not any complaint made or difficulty found as to their mechanical construction. Which of them became so familiar with the use of those looms, and when did they so become respectively?

(Objected to.)

Ans. The Maverick Woollen Company of Dedham, Thomas Barrows, of Dedham, and the Merrimac Woollen Company at Lowell, who received their looms after I had had some experience in constructing them, subsequent to November, 1862, found no fault with the looms. Those companies became familiar with them from the time they received them.

Cross-int. 60. Had those companies previously used any open-shed fancy looms?

Ans. The Merrimac Woollen Company had. I do not know whether the Maverick Woollen Company had or not, nor Mr. Barrows.

Cross-int. 61. In your re-direct examination you say that it frequently occurs that in ordinary fancy-loom weaving a pattern is called for of such a kind as to require the warp threads to be held up or down so long as to involve the embarrassment of such threads becoming relatively longer than the warp threads which were not so held open. Do you refer in that to the broad looms only, or to both broad and narrow?

(Objected to.)

278 Ans. I refer to both.

Cross-int. 62. How many leaves of heddles did each of your broad open-shed fancy looms contain?

Ans. Twenty-four harness, excepting those of Mr. Hodges, of Worcester, which I made for twelve harness. A harness and a leaf of heddles are the same thing.

Cross-int. 63. How many in your narrow open-shed fancy looms?

Ans. Twenty-four.

Cross-int. 64. What do you call a low number of harnesses?

Ans. A few harnesses; from two to ten.

Cross-int. 65. Has not the demand for all power looms diminished since the war—for woollen goods, I mean?

Ans. Soon after the war it increased, but it has lately declined to much less than it was during the war—that is, since the commencement of 1866.

Cross-int. 66. How many open-shed fancy looms, according to your best understanding of the subject, has Sam'l T. Thomas made and sold?

Ans. I never made a calculation how many Thomas looms have been sold, but would guess a thousand.

Cross-int. 67. You say in your re-direct examination that you have not found it for your interest to manufacture your open-shed fancy looms against the competition of the Thomas open-shed fancy looms. Why have you not?

(Objected to.)

Ans. Thomas sold his loom at a low price, considering the extra complication of the open-shed loom. I had a good market for the shut-shed loom to the extent of my then facilities, and did not wish to increase them to bring in the open-shed loom, making it at the remuneration offered, and therefore persuaded my customers to take the shut-shed loom.

Cross-int. 68. In the 27th re-direct interrogatory and answer of your examination, you refer to looms your "exclusive right to which was respected." What looms do you mean by that?

Ans. I mean the close-shed loom.

279 Cross-int. 69. And in answer to the said 27th re-direct interrogatory you say you made most profit on the close-shed looms. Please state what those looms cost you, and what you sold them for.

Ans. The broad looms at that time sold from $275 to $300 each. The price was uniform for both open and close shed looms. The price of the narrow looms I do not clearly remember, but it was about $200 for both narrow and close-shed looms. The difference between the cost of the open-shed and the close-shed would be from $10 to $20 per loom. I may in some cases have sold the open-shed loom for a few dollars more than the close-shed, but the price was generally the same. The open-shed cost the most.

Cross-int. 70. About what time were the cost and your prices for the looms as you stated in your last answer?

Ans. In 1860 and 1861.

Cross-int. 71. Was that the time when you made up your mind it was not for your interest to manufacture open-shed fancy looms in opposition to the Thomas open-shed fancy looms?

Ans. I began to entertain that idea at that time, but made it my settled policy at a later period in 1863 and 1864.

Cross-int. 72. At the time you made it your settled policy in 1863 and 1864, what was the cost of your close-shed looms, for which you say your exclusive right was respected, and what was your selling price for the same?

Ans. I could not give the cost. Nor do I now remember the selling price without reference to minutes which I have not got. But I think in '63 our broad looms were selling for $350; close-shed looms I mean.

Cross-int. 73. State the cost at that time as nearly as you can.

Ans. Well, perhaps from $275 to $300.

Cross-int. 74. Was the cost at that time more or less than it was in 1862?

Ans. It was more.

GEO. CROMPTON.

280 *Deposition of James Cook, taken, subscribed, and sworn to before N. Austin Parks, examiner.*

FEB. 14, 1867.

(Defendants' counsel objects to the examination of this witness, on the ground that the examination of witness Geo. Crompton was not finished.)

Int. 1. State your name, age, residence, and occupation.

Ans. James Cook; age, 72; residence, Lowell, Mass.; occupation at present, the insurance business. I was formerly a woollen manufacturer.

(At this point, counsel for the complainant having inquired of the counsel for defendants whether they were willing that Mr. Crompton's cross-examination should be resumed after certain other witnesses for complainant, present here at inconvenience, had been examined, and having been answered in the affirmative, offers to reproduce Mr. Crompton for further cross-examination, after such intermediate witnesses have been examined, not waiving any right of objection to any questions which have been or which may be addressed to him.

Counsel for defendants states that this being the first time counsel for complainant has proposed for accommodation to interpose the examination of other witnesses before finishing the cross-examination of Mr. Crompton, they of course consent to it, but on condition that Mr. Crompton is to be reproduced and opportunity given of completing his cross-examination.)

Int. 2. Were you connected with the Burlington Mill Company, at Burlington, Vt., in 1849? If so, in what capacity?

Ans. I was agent for the company.

Int. 3. Do you remember the open-shed loom built by Mr. Marshall, or under his direction, and worked there in that year?

Ans. Yes; I do.

Int. 4. Was this loom started before or after the failure of the company?

Ans. Before.

Int. 5. About what time did the company fail?

Ans. I should say it was in the latter part of '49 or '50.

281 Int. 6. Please state generally whether this loom of Mr. Marshall's was satisfactory or otherwise, as a practical demonstration of open-shed fancy-loom weaving.

Ans. It was very satisfactory.

Int. 7. What was the intention of the officers of the company as to providing it with farther looms of that construction?

(Objected to.)

Ans. The intention was to go on and alter the other looms that we had that were of the old Crompton kind.

Int. 8. Alter them to what kind of looms?

(Objected to.)

Ans. To this open-shed loom; this new improvement.

Int. 9. After the company failed, how far and for what purpose did it continue to use the looms it had on hand?

Ans. They continued to use the looms they had on hand till they run their stock out that they then had on hand.

And in answer to cross-interrogatories by J. D. Ball, esq., of counsel for defendants, the deponent saith as follows, viz:

Cross-int. 1. When did your employment commence with the Burlington Mill Company, and when did it cease?

Ans. It commenced in 1844 or 1845—'44, I think; it ended in 1850, if I remember right.

Cross-int. 2. What were your duties while in the employment of that company?

Ans. I was agent for the company.

Cross-int. 3. The performance of what duties did that involve?

Ans. I had the entire management of the operations of the mill, and made such goods as they directed from time to time.

Cross-int. 4. Who or what company succeeded to the business of the Burlington Mill Company?

Ans. I don't recollect at this minute whether the name was altered or not. I don't think it was. It was bought by the Messrs. Harding, of Oxford, Mass.

Cross-int. 5. Did they buy all the looms and machinery in the mill?

Ans. The mill was sold at auction, and they bought everything that was there, as I understood. I was there at the sale.

282 Cross-int. 6. Did they continue the business, and for how long, if you know?

Ans. They did continue the business of manufacturing. They may have made a different class of goods for all I know. They continued for nine or ten years.

Cross-int. 7. Has not that mill been in operation ever since the sale you have spoken of, and under the name of the Burlington Woollen Mills?

Ans. I believe it has been in operation ever since. As I said before, if the name has been altered it is not exactly in my mind.

Cross-int. 8. When did you leave Winooski?

Ans. I believe in 1850; that is, I left the employ of the company in 1849 or 1850. I was there a considerable part of a year after I left the employ of the company.

Cross-int. 9. Did you know Elisha Allen and Ira Allen, who worked at said mill?

Ans. I did.

Cross-int. 10. Please describe the construction of the open-shed loom which you have testified in your direct examination was built by Mr. Marshall.

Ans. The former Crompton loom did not give an open shed which was desirable, and I proposed to Mr. Marshall, he being the machinist there, to see if something couldn't be done to obviate that difficulty. He went to work at it—took a broad Crompton loom into his machine shop and worked at it at different times (didn't give his whole attention to that). After several months he succeeded in completing it so far that we put a web into the loom, and it proved very satisfactory. We thought we had accomplished the whole thing that was desirable.

Cross-int. 11. 10th cross-interrogatory repeated.

Ans. There was an oblong—(objected to because there is no evidence of but one open-shed loom constructed by Mr. Marshall at the Burlington Mills, and that loom has been already fully described by one of the defendants' own witnesses)—wheel with an endless chain, two forks run down on each side of it; on this rigging were two notches, one
283 to take it when it went up and one to take it when it went down. These forks were connected with the jacks on top of the loom and various other rigging that gave us the open shed.

Cross-int. 12. Can you now describe from memory any more fully than you have in your last answer the mechanical construction of that loom?

Ans. I don't think I can, without I have time to look at the rigging and think it over. I could, if I had time, give a full description of it; that is, if I had time to think of it and look at it.

Cross-int. 13. When did you last see said loom?

Ans. I haven't seen it since the company stopped business.

Cross-int. 14. Was it sold with the other property of the company at the time the company failed?

Ans. I think it was. I may not be correct in that.

Cross-int. 15. Did you ever operate said loom yourself?

Ans. I think I have put the belt on and started it; that's the way those looms are run—by power.

Cross-int. 16. Did you ever weave or attempt to weave on it yourself?

Ans. What does that question mean? If it means weaving on the loom and mending up the threads, that's one thing. If it means starting the loom and weaving until the threads break, it's another. If I started this loom, as I have done, it might run a quarter of an hour without breaking a thread. I seldom attempted to mend the threads when they broke, but let some one else do it.

Cross-int. 17. Is it usual for one person to start a loom and another to mend the threads?

Ans. It is in this case, certain.

Cross-int. 18. In any other case is it usual?

Ans. Well, I don't think it is. Generally they take care of their own looms, but it not being my business to tend the loom I left off there.

Cross-int. 19. Have you ever followed weaving as a weaver?

Ans. I never did for any length of time. I have frequently started looms to see them operate, but not to follow it.

Cross-int. 20. What do you mean in your last answer by the words "for any length of time?"

284 Ans. I mean I never followed weaving.

Cross-int. 21. Do you mean by that that you never followed the business of weaving at all?

Ans. I don't think I do exactly, because I profess to know about weaving, if I never followed it for a business.

Cross-int. 22. Did you ever learn the trade of weaving?

Ans. I never served any apprenticeship at it on power looms. I have woven by hand with a shuttle in the old-fashioned way in old times.

Cross-int. 23. Did you ever learn the trade of hand-weaving?

Ans. I did.

Cross-int. 24. When and with whom did you serve your apprenticeship?

Ans. I never served any apprenticeship; I took it up myself. I have woven cotton, woollen, and linen cloth by hand.

Cross-int. 25. Did you ever weave any on power-looms? And, if yea, please state fully to what extent.

Ans. I never did to any great extent, any more than I have stated before, to start looms and see if they would go right.

Cross-int. 26. You say that you are in the insurance business; how long have you been in that business, and in what capacity?

Ans. For about eight years, as agent for various companies, life, fire, and marine.

Cross-int. 27. After leaving the employment of the Burlington Mills Co., what business did you follow?

Ans. Manufacturing woollen goods for two years, I think, at Uncasville, Norwich, Conn. For about three years I didn't do much of anything—didn't have any business in particular before I took up the insurance.

Cross-int. 28. In what capacity were you manufacturing at Uncasville, Conn., and what kind of goods?

Ans. I was agent for the Uncas Company. We made cassimeres, doeskins, fancy goods of various kinds, coatings, coarse and heavy, which is, I believe, about all that we made there.

Cross-int. 29. Do you know of your own knowledge what became of the said Marshall loom?

285 Ans. I do not; I don't recollect now.

And in answer to direct interrogatories, resumed by C. Browne, esq., deponent saith as follows, viz:

Int. 10. What did you do, and how much, and how often, in order to satisfy yourself as to the working of the Marshall open-shed loom, after it had been built at the Burlington Mills?

Ans. In passing about the weave-room I stood by the loom and saw it operate from time to time; operated it myself, as I have stated before.

And in answer to cross-interrogatories by J. D. Ball, esq., deponent saith:

Cross-int. 30. What do you mean by operating it yourself, as stated in your last answer?

Ans. As I have stated before, putting the belt on; what we call starting the loom and seeing it run.

Cross-int. 31. Will you swear that you yourself wove as much as a quarter of a yard of cloth on that loom?

Ans. I might not have woven a quarter, but I should be willing to swear that I wove an eighth of a yard upon the loom at different times.

JAMES COOK.

Deposition of Thomas Barrows, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 14, 1867.

Int 1. State your name, age, residence, and occupation.

Ans. Thomas Barrows; age, 71; residence, Dedham, Mass.; occupation, cotton and woollen manufacturer.

Int. 2. Please state briefly what experience you have had in the management, as superintendent or owner, of fancy-woollen mills.

Ans. I've been connected with the cotton and woollen manufacture since the fall of 1812. The latter part of my life has been all in fancy woollens and broadcloths, since 1825.

286 Int. 3. How early did you have charge of a woollen mill?

Ans. I had charge of a woollen and cotton mill together in the fall of 1815. The woollen manufacture was very small at that time.

Int. 4. Are you connected with any fancy-woollen mills in Dedham or elsewhere; if so, in what capacity?

Ans. I was agent of the Dedham Woollens, so called, up to 1842. After that it was called the "Maverick." In 1842 I think it took that name. We then commenced with the fancy looms (in 1842). We had some from Mr. Crompton, some from Philadelphia, and two, I think, from Mr. Thomas, fancy Jacquard, and some of the Greenhalgh looms from Woonsocket Falls, and continued to use those looms up to August 1st, 1864. Then the name of the concern was changed again, and I left it; bought a cotton mill of my own, and put in woollen machinery.

Int. 5. What is the name of this woollen mill of your own?

Ans. I mark my goods "Thos. Barrows' Woollen Mill."

Int 6. Did you have any Crompton open-shed fancy looms at the Maverick; if so, how many?

Ans. My recollection doesn't serve me exactly how many there were; from 20 to 40.

Int. 7. Built by George Crompton, of Worcester?

Ans. Yes, sir.

Int 8. When you bought your own cotton mill, after August 1st, 1864, what fancy looms did you stock it with?

Ans. With Mr. Crompton's open-shed looms, all that I could get made. He couldn't make all I wanted.

Int. 9. How many of such open-shed looms have you put into your mill?

Ans. About sixteen; they were broad looms. I have about a dozen narrow looms.

Int. 10. At about what rate do you run these Crompton open-shed looms?

Ans. 83 or 84 picks.

Int. 11. In your experience of the Crompton open-shed looms, how have you found them as to correctness of action?

Ans. I have found them very correct.

287 Int. 12. How have you found them to compare with close-shed fancy-woollen looms as to desirableness in the majority of patterns?

Ans. I give them the preference.

Int. 13. Are there any patterns for which you have found a close-shed loom more desirable; if so, how frequent is the necessity for such patterns?

Ans. I very seldom meet with them; one in fifty perhaps.

Int. 14. Is there any difference as to the efficiency of the open-shed fancy looms, whether you are working beaver or light goods?

Ans. There is a preference in either for the open-shed looms.

Int. 15. What was the usual rate of speed at which narrow fancy looms were run as long ago as 1850, if you remember?

Ans. My recollection is that they were 80 picks a minute.

Int. 17. Have you ever been connected with any mill in which Thomas open-shed fancy looms have been used?

Ans. Yes; the Merrimac Woollen Mill at Dracut, in this State.

Int. 17. Generally speaking, was the operation of those looms satisfactory or unsatisfactory?

Ans. They were unsatisfactory.

And in answer to cross-interrogatories propounded to him by J. D. Ball, esq., of counsel for defendants, deponent saith:

Cross-int. 1. Please state whether or not the mills belonging to said Merrimac Woollen Mill were destroyed by fire; and, if so, when.

Ans. They were, I think, about two years ago last December. It may be less time.

Cross-int. 2. In your answer to 10th direct interrogatory, you say you run those Crompton open-sh d looms 83 or 84 picks; please state what width of goods the looms running at that rate make.

Ans. They make 74-inch goods in the looms.

Cross-int. 3. Then the looms running at that rate are broad looms, are they not?

Ans. Yes, sir.

Cross int. 4. Was there any difference in the mechanical construction of any of the Crompton open-shed looms which you have referred to in your direct examination?

Ans. Very slight, if any.

288 Cross-int. 5. When did you get the last of those Crompton open-shed looms?

Ans. Three years ago next spring, I think.

Cross-int. 6. Please state whose make of looms you refer to in your answer to 15th interrogatory.

Ans. Crompton's close-shed looms, Philadelphia looms, Greenhalgh looms, and I think we ran about the same with other looms.

Cross-int. 7. What was the maximum rate of speed of narrow fancy looms in 1850?

Ans. I can't say how other people ran their looms.

Cross-int. 8. In giving the usual rate of speed at which narrow fancy looms were run in 1850, do you speak only of those looms run in the mill where you were?

Ans. I speak of my experience. My experience is on my own looms.

Cross-int. 9. What was the maximum rate of speed at which your own narrow fancy looms were capable of being run in 1850?

Ans. 80 picks a minute.

Cross-int. 10. Could you have run your own narrow fancy looms in 1850 more than at the rate of 80 picks a minute?

Ans. I did run some more and some less.

Cross-int. 11. What was the highest rate at which you run some?

Ans. Well, 85 perhaps, as near as I can recollect.

Cross-int. 12. Will you be kind enough to permit us to examine the Crompton open-shed looms that you have?

Ans. I shall be very happy to see all you gentlemen at my mill.

THOMAS BARROWS.

Deposition of Samuel T. Thomas, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 15, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. Samuel T. Thomas; age, 59 years; residence, Laconia, N. H.; occupation, manufacturer.

289 Int. 2. Do you know whether any patterns which were used for making the so-called Marshall loom, which was set up and tried at the Arlington Mills in Lawrence, are in existence?

Ans. I don't know whether they are or not.

Int. 3. Where did you last see them, or know of their being?

Ans. I saw a portion of them in Mr. Cole's shop in Lake Village, N. H., previous to their being used.

Int. 4. Have you seen any of them since they were used?

Ans. I have not.

Int. 5. Have you any opinion as to where those patterns, or any of them, can now be found?

Ans. If they are in existence, probably at Mr. Cole's shop.

Int. 6. Have you any reason to suppose they are not in existence?

Ans. I don't know that I have.

Int. 7. Was that loom built in Mr. Cole's shop?

Ans. It was.

Int. 8. By whom?

Ans. By Mr. Cole and his workmen.

Int. 9. By whose direction?

Ans. I ordered the loom built. I placed the model—(counsel for complainant objects to the witness doing any more than answering his questions)—a certified model from the Patent Office at Washington, in the hands of Mr. Cole's foreman, and ordered a full-sized loom made like that model.

Int. 10. What is Mr. Cole's full name?

Ans. B. J. Cole & Co., the firm is.

Int. 11. What is his foreman's name?

Ans. John Leavitt.

And in answer to cross-interrogatories propounded to him by J. D. Ball, esq., of counsel for respondents, deponent saith as follows, viz:

Cross-int. 1. You say you placed a certified model from the Patent Office at Washington in the hands of Mr. Cole's foreman; please state what it was a certified model of.

(Objected to.)

290 Ans. The Marshall open-shed loom.

Cross-int. 2. What became of said certified model, and the Marshall loom that was built as stated in your direct examination?

(Objected to.)

Ans. They were burned in the Arlington Mills at the time they burned down.

Cross-int. 3. When were they burned in that mill? And state whether the whole mill and its contents were consumed.

(Objected to.)

Ans. I don't know the date. I think about November last. The whole mill and contents were consumed.

Cross-int. 4. What was B. J. Cole & Co.'s business?

Ans. Building machinery—looms and other machinery.

Cross-int. 5. Do you know Moses Marshall?

Ans. I do.

Cross-int. 6. State whether or not he has been here present on various days, during the taking of the testimony in behalf of the complainant in this case, and whether or not he was here yesterday.

Ans. He has, and was here yesterday.

SAMUEL T. THOMAS.

(The counsel for the complainant here requests the counsel for the defendants to give him a letter to B. J. Cole & Co., asking them to send here to this commission the patterns inquired about in the direct examination, transportation to be at the expense of the complainant.

Counsel for defendants make no answer to this request.

Counsel for defendants call upon the compiainant's counsel to produce the deed of May 5th, 1859, and the assignment of Dec. 19, '63, alleged in the bill of complaint to have been made by Moses Marshall to the complainant; also the deed mentioned in said bill, as dated May 5th, 1859, by which it is alleged in said bill, that said Marshall covenanted with the complainant to sell, and assign to him the extended term of the patent therein mentioned, profert of all of which is made in said bill of complaint.

Counsel for the complainant, not hereby admitting the regular-
291 ity or sufficiency of the demand thus made, and at this stage of the case, produces and places in the custody of the examiner the said deed, dated Dec. 19, 1863.)

Adjourned to 2 p. m.

Deposition of Edward Barrows, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 15, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. Edward Barrows; age, 39 years; residence, Dracut, Mass.; occupation, manufacturer; agent of the Merrimac Mills.

Int. 2. How long have you been agent of those mills?

Ans. I think five years next April.

Int. 3. Has your mill been burnt down within that time, and rebuilt; if yea, when was it?

Ans. It was burned down two years ago last October, I think, and rebuilt afterwards.

Int. 4. At the time of the fire, did you have in that mill any open-shed fancy looms; if so, about how many, and of whose make?

Ans. We had twenty of the Thomas broad looms.

Int. 5. Was the operation of those looms satisfactory or unsatisfactory?

Ans. It was not very satisfactory.

Int. 6. When the mill was rebuilt, what fancy looms did you put in to supply the place of those Thomas open-shed looms which had been destroyed with the mill?

Ans. The Crompton close-shed looms.

And in answer to cross-interrogatories propounded to him by Geo. Gifford, esq., of counsel for respondents, deponent saith as follows:

Cross-int. 1. What was your business previous to becoming agent of those mills?

Ans. I was assistant of my father, Thomas Barrows, then agent of the Maverick Mills.

292 Cross-int. 2. Are you a practical weaver?

Ans. No, sir.

Cross-int. 3. Are you sufficiently familiar with the open-shed looms to state what was the difficulty with them, if anything, or do you prefer close-shed weaving?

Ans. Before I answer that—there seems to be two questions in one.

Mr. GIFFORD. Answer the question.

WITNESS. I'll answer part of it; I won't answer the whole of it in one answer.

Ans. I am. I prefer the open shed.

EDWARD BARROWS.

Deposition of Henry B. Renwick, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEBRUARY 15, 1867.

Int. 1. Look at the model now shown you, and marked "Complainant's Exhibit D," in which there are depressions formed in the periphery of the sector, for the friction brake to drop into when the sector is at its two extremes of motion, and suppose Model B had all its sectors made like that shown in this Model D, would Model B, when so altered, have substantially the same combination of jacks, lifter and depresser, pattern mechanism, heddles, and holding mechanism for the purposes of those parts in the Marshall loom that it now has, or substantially a different one?

(Objected to.)

Ans. It would have substantially the same combination, for reasons that I have already stated, my opinion being that Model B would be only altered in degree by the change proposed in the question. By this alteration the brake is made to oppose a little more resistance to the motion of the sector than it does in Model B, at the time when the sectors are stationary; but it still acts as a brake acts, both when the sectors are moving and when they are stationary, the action of a brake

293 being to cause the minute inequalities of the braking surface to engage with the minute inequalities of the surface which is to move in opposition to the pressure of the brake, or be prevented from moving by that pressure and consequent engagement of the minute asperities of the braking surface, and that to which it is applied.

Int. 2. Suppose the concentric portions of the slots in the sectors of the loom Model B to be removed therefrom, or the loom to be run with so small a shed that those concentric portions are not brought into action to hold the leaves of heddles up or down, and suppose the leaves of heddles are so held, maintaining the open shed, by means of the friction brakes applied with sufficient pressure against the peripheries of the cam sectors, would the loom Model B, when so altered or when so operating, have substantially the same combination of jacks, lifter and depresser, pattern mechanism, heddles, and holding mechanism, for the purposes of those parts in the Marshall loom, that it, the said loom Model B, now has, or a substantially different one?

Ans. It would have substantially the same combination of mechanism enumerated in the question, but would have an inferior and less positive and practically useful equivalent for the locking mechanism. Under the change supposed in the question, the brake, instead of performing the office, as I have before stated, of an adjunct to the locking notches,

would become the whole locking mechanism, and, when it so became the locking mechanism, the loom would take more power to run it, and the action of the loom would be less certain, as the sectors would be liable to slip under the brake, especially when an adjacent sector was moved, thereby causing movements of leaves of heddles which ought to be kept stationary.

Int. 3. Were or were not a friction clutch and a friction latch known substitutes for one another, prior to the date of the Marshall patent, for the purpose of arresting moving surfaces?

(Objected to.)

Ans. I may not understand precisely what is referred to in the question, but in my mind the term clutch is only applicable to those contrivances which move or prevent the movement of rotating bodies
294 or surfaces, while the term latch is applicable more especially to that class of connections which prevent or admit of the motion of bodies moving in some other way than by a motion of rotation, and according to my understanding of the terms they were not substitutes for one another.

Int. 4. Previous to the year 1849, were latches which took into notches, and latches, or brakes, or cams which bore upon comparatively smooth surfaces, known mechanical substitutes for each other for the purpose of retaining moving bodies in position?

(Objected to as not being in answer to anything that the respondents have proved.)

Ans. They were, especially as window catches to prevent sashes from falling, such catches being either latches taking into notches when forced by a spring or weight, or rubbing surfaces applied to the sash and bearing against the window frame or vice versa.

Int. 5. In the loom represented by Model B, assuming the notches in the sectors to remain, and the heddles to be omitted, what holds the sectors in position?

(Objected to.)

Ans. The brakes.

Int. 6. Under the same state of facts, what holds the jacks in position?

(Objected to.)

Ans. The brakes.

Int. 7. Please look at the sketch now shown to you marked "Exhibit E, N. A. P., Ex'r," and say whether if sectors and springs like those shown in that sketch, as explained at page 165 of the record, were substituted for those now shown by Model B, it, Model B, would then in your opinion contain substantially the same or substantially a different combination of jacks, lifter and depresser, pattern mechanism, heddles, and holding mechanism, as said Model B now does for the purposes of the loom.

(Objected to.)

Ans. As I understand the question, the springs of Exhibit E are to take the place of the springs and brakes now shown in Model B. If such substitution were made, I should consider that the model con-
295 tained the combination recited in the question in the same manner that it now does, the only difference in the holding action upon the circumference of the sectors between Exhibit E and Exhibit D being that in the former there are two springs, one to hold the sector at each end of its motion, while in the latter there is a single spring so arranged as to hold the sector at both ends of its motion.

Int. 8. Suppose the spring latches to be removed from Model A, and brakes to be applied, with or without notches, to the peripheries of the

collars through which the upper series of heddle levers pass, being the construction exhibited in model now shown you marked "Exhibit F," and state whether in your opinion the combination of jacks, lifter and depresser, pattern mechanism, heddles, and holding mechanism would be substantially similar to, or substantially different from, that now shown in "Exhibit A" for the purposes of the loom.

(Objected to.)

Ans. It would be substantially the same. As I have before stated, the two modifications of brakes or locking mechanism shown in Exhibit F differ only in degree and not in kind. They both lock the heddle and the jacks in position, but in a less positive manner than the spring latches described in the patent, and when they are used they would require more power to be applied to work the loom. They are, therefore, inferior equivalents. They are, moreover, changed in location from the jacks to the heddle levers; but as, at the period of time at which Marshall's patent was granted, I know of no latches applied in the combination recited in the question, it does not appear to me that the invention depends either upon the precise location of the locking mechanism, or the manner of unlatching it, and, taking these considerations into the question, I have no doubt that the combination recited in the question as in the Marshall loom would remain substantially unchanged by the alteration supposed in the question, and exemplified by Model F.

Int. 9. Will you look at the loom model labelled "Defendants' Exhibit 5," and state what kind of loom that represents—to what class of loom it belongs?

Ans. It represents an old-fashioned cam-loom of the open-shed
296 variety, the cams being variable, so that different patterns may be woven by changing the sections of the cam.

Int. 10. Will you compare the loom represented by Exhibit No. 5, and the loom described and represented in the Marshall reissue patents and exhibited in Model A, and say whether you find in the former substantially such a combination of jacks, lifter and depresser, pattern mechanism, heddles, and holding mechanism as are described and represented in said patent for the purposes there specified, or a substantially different one, and give your reasons pretty fully. [And make the same comparison, as you go along, between the loom represented by Model No. 5, and the loom represented by Model B.]

(That part of the question in brackets objected to.)

Ans. I do not find in Model No. 5 the combination referred to in the question, and existing both in Model B and Model A. In both Model B and Model A there is a pattern mechanism, whose sole purpose is to select the jacks by moving them sidewise, such motion of the jacks imparting no motion at all to the heddles, the pattern chain being in both looms a selecting mechanism and nothing more; whereas in Model 5 the protuberances on the cams at the same time dictate what heddles are to be moved and actually move the heddles.

In both the models A and B I find a series of jacks capable of motion and in the operation of the loom being moved in two directions, the one motion sidewise and derived from the pattern chains, and the other motion up and down and derived from the lifters and depressers. In Exhibit 5 there are no jacks nor no pieces of metal, by whatever name they may be called, having such motions and such mode of operation. There are in the loom swinging levers provided with rollers, and operated upon by cams to lift and depress the heddles.

In both Model A and Model B there are lifters and depressers, one of which moves up and the other down at every pick of the loom. These

lifters and depressers are common to all the jacks in each loom, and are always ready to move any jack that may be presented for their action by the operation of the pattern mechanism. In Exhibit No. 5
297 there are no such lifters and depressers, nor any pieces of metal, whatever they may be called, having their mode of operation. There are in Model 5 cam protuberances, which do lift and depress heddles, but there is at least one protuberance for each leaf of heddles, and each protuberance can act only upon its own leaf of heddles, and upon no others, and does not move so as to be capable of acting upon a heddle at every beat of the lay for every pick.

There is in Exhibit 5 a series of locking mechanisms or devices for holding the heddles for a series of picks, not more than seven, in either elevated or depressed positions, and these locking mechanisms, so far as they act merely to lock the heddles up and down, are not substantially different from the locking mechanisms in Models A and B.

Int. 11. What practical advantages, if any, which are common to the Marshall loom and the Thomas loom, due to their both containing the combination mentioned in the last interrogatory, do you find lacking in the loom represented by Model No. 5, because of its not forming such combination?

(Objected to.)

Ans. In the first place, the looms of Marshall and Thomas can weave patterns which do not repeat themselves for as great a number of picks as there may be links in the chain; whereas in the loom represented in Model 5 the pattern must repeat itself at every eighth pick. It is true that without altering the principle of this loom, the cam might be made large enough to cover as great a range of patterns as most pattern chains; but in that case the cams would be so large that it would be impracticable to connect them directly with the looms. You would have to put the cam in one story of the building, and the loom in the room above.

Another practical advantage which the looms shown in Models A and B have by reason of their both containing the combination mentioned in the last interrogatory, is that the pattern may repeat itself at any desired pick, for instance, the 6th, 9th, 15th, 20th, 30th; whereas in looms like Model No. 5 the patterns can be repeated only in picks whose numbers are factors of the number of picks during each revolution of the cam. For instance, the cams in Model 5 revolve in eight
298 picks, and they can weave patterns only which repeat at the 2d, 4th, and 8th picks. They cannot weave patterns which repeat at the 3d, 5th, 6th, or 7th pick; and if it is desired to weave such patterns, both the cam and the gearing which moves them must be changed.

Adjourned to 16th, at 9½ a. m.

Examination resumed: FEB. 16*th*.

Int. 12. Have you examined the Marshall open-shed loom which has been recently built in the factory of the complainant at Worcester, as testified by Mr. Wyman?

Ans. I have.

Int. 13. Is or is not that loom constructed in conformity with the specification and drawings of the Marshall reissue patent upon which this suit is founded?

Ans. It is.

Int. 14. Did you examine the so-called Marshall loom which was operated in the Arlington Mills at Lawrence, as testified by witnesses for the

defendants? If so, when did you make that examination, and accompanied by whom?

Ans. It was, I think, on the 13th of September, 1866, accompanied by Mr. Browne and Mr. Crompton. We met there Mr. Moses Marshall, Mr. Ball, Mr. E. S. Renwick, Mr. Treadwell, and, I think, some others. I examined the loom on this occasion, but did not see it operated.

Int. 15. Did you find that loom to be constructed in conformity with the specification and drawings of the Marshall reissue patent?

Ans. Not in exact accordance.

Int. 16. Wherein did you find it to differ therefrom; and will you state, together with the points of difference, if any, how far such points of difference would be liable to affect the operation of the loom?

Ans. The chief points of difference were, first, in the gearing conveying the motion from the lay shaft to the evener, lifters and de-
299 pressers, and pattern chain. I refer to the three eccentric gears lettered h^1, i^1, and k^1. In the loom at the Arlington Mill those gears, instead of being circular and mounted on eccentric axes, were gears whose peripheries were curves apparently struck from three different centres, and the farthest of those gears from the crank-shaft was arranged differently from the arrangement shown in the patent, viz., off at one side and lower than in the drawing. The changes in the shape of this gearing would cause pertubations in the movements of the parts driven by them, and the change in arrangement would cause a different speed in the gear which was out of arrangement, at a given moment of time in the action of the loom, from that which the gear would give if properly arranged. In that loom also the motion of the pattern chain was derived from the crank-shaft directly by means of a pin on the crank-shaft and a connecting rod leading from it, whereas in the patent the motion of the pattern chain is derived from gearing driven through the intervention of the eccentric gears. It was, therefore, both possible and probable that the pattern chain moved at a different rate of speed from the pattern chain of the patent; and the relative speed and times of motion of the eveners, lifters and depressers, and pattern chain, which are all important in the working of the loom, may have been, on account of these changes, and probably were, different from those described in the patent. The lance heads on the upper series of heddle levers were more obtuse than those represented in the patent, and the rollers acting upon them were smaller. These latter facts, taken in consideration with the gearing which drove the evener, may have influenced, and probably did influence, the correct action of the evener.

Int. 17. You say that the differences in construction which you have mentioned may have affected, and probably did affect, the accuracy of the working of the loom; why do you say "probably did?" How may such results have been averted?

Ans. I say probably, because those changes would have necessitated a careful adjustment and proportioning of the various connecting mechanisms in order to make the acting parts work properly, and also because I have heard it testified to in substance that the Arlington Mills loom
would only work at a very low rate of speed, and even then im-
300 perfectly. The probability as derived from the consideration of the testimony may be, perhaps, of little importance, for the reason that the loom, as far as I could judge, was of rough and inferior workmanship, and that alone may have caused its uncertainty of action and low rate of speed.

Int. 18. Do you remember whether or not the shape of that part of the jacks against which the chain rollers bore was as described and represented in the Marshall reissue patent?

Ans. I do not remember whether it was or was not.

Int. 19. What would be the effect in the loom of making the jacks at that part straight or considerably less curved than the reissue patent describes or represents?

Ans. As I understand, the curve should be of such a character as has already been testified to by others in this case, that the jacks should substantially move up and down in a straight line; and if the curves were such as to cause the jacks to oscillate in their motion, it would tend to throw, and might throw, the hooks off of the elevator and depresser, and thereby cause the loom to operate uncertainly.

And in answer to cross-interrogatories by George Gifford, esq., of counsel for respondents, deponent saith:

Cross-int. 1. What effect do you think, having the spear heads of the upper heddle levers more obtuse in the loom than is shown in the Marshall patent, and the rollers of the eveners smaller than is shown in the patent, would produce in the operation of the loom?

Ans. If the other parts of the loom were unchanged, it would cause the heddle levers to move, when struck by the evener, with a greater rate of speed.

Cross-int. 2. In the Marshall loom which you saw at Crompton's, did not the evener hold all the jacks in the loom and consequently all the heddles, in their extreme positions, up and down?

Ans. It did, at certain times. The latches held them while the other sheds were being shifted.

Cross-int. 3. At what times did the evener hold them? Specify all such times.

301 Ans. So far as I remember, it held them either up or down while the shuttle was traversing the warp thread.

Cross-int. 4. Do you mean that it held some up and some down while the shuttle was traversing through the warp?

Ans. I do.

Cross-int. 5. Did it not hold all up and all down which it was necessary to have held up and down while the shuttle was traversing through the warp?

Ans. It did. That is precisely what I intended to convey by my former answer.

Cross-int. 6. Do the latches in that loom hold the heddles in their extreme position up or down while the shuttle is traversing the warp?

Ans. They do not.

Cross-int. 7. Is there anything except the evener in that loom which holds the jacks and the leaves of heddles in their extreme position up or down during the passage of the shuttle through the warp?

Ans. There is not.

Cross-int. 8. In that loom, when the lifter and depresser are approaching their highest and lowest positions, do they not strike against the shoulders of all the jacks that are not being shifted at the time?

Ans. I believe that either the lifter or the depresser strikes against the shoulders, the lifter striking against all those that are up and the depresser against all that are down.

Cross-int. 9. State whether or not the curvatures of the jacks in that loom are copies of the curvatures of the jacks as represented in drawings of the Marshall patent.

Ans. What curvatures of the jacks?

Cross-int. 10. I mean where the pattern chain acts upon them.

Ans. I never compared it specially with the drawings alone to see. I

was satisfied with seeing the fact that the jacks moved up and down in substantially straight lines.

Cross-int. 11. State whether or not the spaces between the prongs of the jacks compared with the lifter and depresser chain are in the same proportion in that loom as they are represented in the drawings of the Marshall patent.

302 Ans. I did not measure. As far as I could judge by eye, holding the drawing alongside the loom, they were.

Cross-int. 12. Was the range of motion of the lifters and depressers in that loom in the same proportions to the distance between the upper and lower series of spring catches as is represented in the Marshall patent and particularly in the drawings thereof?

Ans. As far as I could judge by eye it was.

Cross-int. 13. I will now call your attention to the Pierce loom, represented by model Exhibit 5, and ask you whether or not you find in that model a pattern mechanism?

Ans. There are in it a set of cams which control the pattern to be woven. They are not what I should call a pattern mechanism in the way I understand the term.

Cross-int. 14. What do you call a pattern mechanism as you understand the term?

Ans. A mechanism which dictates which heddle shall be shifted and in what direction, without moving or shifting them at all.

Cross-int. 15. Then, according to your view, a mechanism which dictates which heddle shall be shifted and in what direction, if it does nothing more, is a pattern mechanism, is that so?

Ans. I think so.

Cross-int. 16. Now, suppose that a mechanism does those two things, and another thing in addition thereto, would that, in your view, be a pattern mechanism?

Ans. It might be. It is a mere question of the ordinary acceptation of the meaning of technical terms.

Cross-int. 17. Would it be?

Ans. Would what be?

Cross-int. 18. What was asked you in cross-question 16, which is here repeated.

Ans. It might be. I can't tell whether it would or not come within the ordinary acceptation of the term unless the contrivance was shown to me.

Cross-int. 19. When you say it might be, what, if anything, do you mean thereby different from the expression "it would be?"

Ans. "Might" implies uncertainty to me, and "would" does not.

303 Cross-int. 20. If a mechanism dictates which heddle shall be shifted and in what direction, how can it be uncertain as to its being a pattern mechanism? Explain, if you have any explanation to give.

Ans. Because that it might at the same time and by the same act and motion also shift the heddles, and thus, according to my understanding of the term, it would not be a pattern mechanism, although, as I have before said, it would be a mechanism to control the pattern to be woven.

Cross-int. 21. Suppose a mechanism which dictates which heddle shall be shifted and in what direction, and that it does nothing else, and in that condition it be used three months, at the end of which period somebody makes an addition thereto, so that the same mechanism does what it before did, and is also employed in doing something else, was such

mechanism, in your view, during the three months a pattern mechanism?

Ans. As I understand the question, without knowing what mechanism you have in your mind, I should think that it would, in those three months, be a pattern mechanism.

Cross-int. 22. In your view, did such mechanism cease to be a pattern mechanism at the end of the three months after the addition was made which was specified in the last question?

Ans. As I don't know what the precise mechanism was, nor what changes were made in it, nor what it did when it was changed, I can't tell.

Cross-int. 23. It was a mechanism which dictated which heddle shall be shifted and in what direction and nothing more, before the addition was made. The addition was such as left that mechanism to do those two things as before, but enabled it, or caused it, to aid in doing something more. With this explanation, please answer the last question.

Ans. I do not understand the explanation as going any farther than the previous question (which may be owing to my obtuseness), and I therefore give it the same answer.

Cross-int. 24. Have you now answered the 22d cross-interrogatory to the best of your ability?

304 Ans. Yes, I have.

Cross-int. 25. Is there a pattern mechanism in your estimation described in the Marshall reissue patent?

Ans. There is.

Cross-int. 26. According to your view, why is that a pattern mechanism?

Ans. Because it dictates which heddle shall be shifted and what pattern shall be woven without shifting the heddles.

Cross-int. 27. Suppose that to that pattern mechanism you make an addition, so that the action of the pattern chain were to aid in doing something else also, without any other change, would the pattern mechanism still remain?

Ans. Describe to me the additions and what duty they are to perform and the other changes in the loom incident to them, and I will endeavor to answer the question.

Cross-int. 28. Suppose any addition coming within the range of the last question, and then answer.

Ans. I can't make any such supposition, because I can't conceive of any addition to the pattern chain without any other change in it which would enable it to do some additional duty and still perform the duty which it now performs.

Cross-int. 29. Suppose an addition be made to the Marshall loom so that the motion of a jack, after being selected by the pattern chain, is made available to do something in addition to what it does as represented in the Marshall patent, would such addition cause the pattern mechanism to cease to exist, or would it still remain to be a pattern mechanism?

Ans. As I can't think of anything in the loom that the motion of the jacks could be made to do in addition to their moving the heddles, I can't make the supposition necessary to answer the question.

Cross-int. 30. Suppose you connect the ends of levers to the leaves of heddles, having the fulcrum of those levers in or near the centres of them, then the motion of the jacks would result in moving those levers, as well as the leaves of heddles, would it not?

Ans. The motion of the jacks derived from the lifters and depress-

305 ers would move those leaves, but the leaves would do nothing, and be a worse than useless incumbrance to the loom.

Cross-int. 31. Would not the action of the lifters and depressers upon the jacks be dependent upon the pattern chain?

Ans. If I understand you aright, that is the action in the loom now, for the lifters and depressers to act upon such jacks as may be selected by the pattern chain.

Cross-int. 32. Cross-interrogatory 31 repeated.

Ans. Answer repeated.

Cross-int. 33. Is that the most direct answer you can give to the 31st cross-interrogatory?

Ans. I think it is, without danger of being misunderstood; because it is very evident that the lifters keep going up and down even when the pattern chain does not move at all.

Cross-int. 34. Would the addition or existence of the additional leaves supposed in the 30th cross-interrogatory cause the pattern mechanism represented in the Marshall loom to cease to exist, or would it still remain?

Ans. It would still remain.

Cross-int. 35. If to some part of a flour mill you connect a bark mill by means of a belt and suitable pulleys, would such connection of the bark mill cause the flour mill to cease to exist, or would the flour mill still remain?

Ans. It seems to me that it is self-evident that the flour mill would still stay there.

Cross-int. 36. In model Exhibit 5, according to your judgment, is there a mechanism which selects bars or parts, the motion of which moves the heddles?

Ans. I shouldn't call it selection. It moves those bars or parts when the protuberances upon the cams come round. I'll call it selection if you wish me to.

Cross-int. 37. In Model "5," according to your judgment, is there mechanism which dictates bars or parts to be moved, the motion of which moves the heddles?

Ans. There is. The same cam protuberances before named by
306 me, which at the same time and by the same motion dictate and move the bars, and consequently the heddles.

Cross-int. 38. After such mechanism has so dictated which bar shall be moved in model Exhibit 5, is such bar then either depressed or elevated?

Ans. No; the dictation and elevation and depression in that loom are all one thing and done at the same time.

Cross int. 39. What part of one of the pieces which you call cams—say take an inside one—dictates what bar shall be moved?

Ans. I don't understand that any part of the cam does dictate what bar shall be moved and do nothing more. The inclined plane that leads from the inner to the outer concentric part of the cam moves the bars, and, as it may be called, at the same time dictates what bars are to be moved; but the motion and the dictation are done at the same time, and by the same instrumentality.

Cross-int. 40. In that case, if the bar is to be elevated, its motion upward is commenced by the action of the lower part of that inclined plane, is it not?

Ans. Yes.

Cross-int. 41. Now, suppose that instead of that inclined plane a square end were made to that cam, what would be the effect?

Ans. I should think the loom would smash up.

Cross-int. 42. After the roller in the bar in Exhibit 5 has travelled the length of the concentric surface of the piece on to which it was elevated by means of that inclined plane, what then takes place as to that roller and its bar?

Ans. The continued revolution of the cam draws the roller of the lever into another inclined plane groove and hauls the roller down.

Cross-int. 43. Suppose that instead of the roller then descending an inclined plane, that end of the piece or the concentric surface on which the roller travelled were made square, what would be the effect?

Ans. As I understand it, the roller don't travel on the inclined plane attached to the end of the concentric surface, before spoken of, when it is pulled down, but as it descends travels on the inclined plane attached to the outer rim of the cam, which is the effective instrumentality in pulling the roller down. You might make square that end of the
307 concentric which is opposite the pulling down inclined plane before spoken of without materially affecting its utility so long as it was not necessary to reverse the loom, which necessity often happens in weaving. The squaring spoken of in the question would prevent the reversing of the loom without breaking it.

Cross-int. 44. We have now placed the roller of a bar up an inclined plane at the end of one of the pieces and along its concentric surface and down at the other end of such piece, now state what was the effect upon the heddle of the roller going up that inclined surface.

Ans. To depress the heddle connected with the roller.

Cross-int. 45. What was the effect upon the heddle of the roller going down at the end of such piece?

Ans. To elevate the heddle.

Cross-int. 46. What was the effect upon the heddle and upon the warp threads of such roller remaining upon the concentric surface of said piece until it had travelled from one end to the other of it?

Ans. To hold the heddle, and consequently the warp threads it carries locked, down.

Adjourned to 2½ p. m.

Resumed:

Cross-int. 47. It has been explained how a leaf of heddles is depressed and elevated and locked down for a desired length of time in Exhibit 5. Please explain by what means therein a leaf of heddles is elevated and locked or held up a desired length of time and then depressed.

Ans. A leaf of heddles is elevated, as before explained, by the inclined plane leading from the outer to the inner periphery of the outer rim of the cam groove, and is held elevated and at rest by the roller resting in the concentric portion of the groove and being enclosed thereby. When that concentric portion ends and a protuberance or inclined plane commences, the roller rides up on the protuberances and depressess a leaf of heddles.

Cross-int. 48. You speak of the cam grove—is anything more
308 necessary than the inner surface of the outer rim to support the roller of the bar to hold a leaf of heddles elevated and at rest?

Ans. Nothing more is necessary to hold it elevated; the other side is necessary to hold it at rest.

Cross-int. 49. Does the rollerof the bar which, by bearing on the inner side of the outer rim holds the leaf of heddles elevated, while so holding touch or derive any assistance from the inner rim, or from anything on the opposite side of the inner surface of said outer rim?

Ans. While it is actually holding them, I do not think it does. I have never seen the loom working, but that is my opinion from examination of the model.

Cross-int. 50. How many picks is the mechanism adapted to or arranged for as now represented in Model A?

Ans. It is arranged for any number of picks as long as you may desire to run the loom.

Cross-int. 51. As arranged, can you repeat the pattern at any number of picks?

Ans. Not with that length of chain, but by putting additional links in the chain, without any other alteration in the loom, it can repeat at any desired number of picks.

Cross-int. 52. Then as the model now stands, without making any alteration in it, what number of picks can it repeat on?

Ans. 8, 4, and 2.

Cross-int. 53. To be able to repeat on three or six picks in Model A you would have to increase the capacity of the pattern mechanism by addition, would you not?

Ans. In the precise construction of that chain and its driving barrel, as represented in that model, you would have to put more links in that chain, increasing it either to 9, 12, or 18 links.

Cross-int. 54. Cross-interrogatory 53 repeated.

Ans. Answer repeated.

Cross-int. 55. Have you now given as direct an answer to the 53d cross-interrogatory as you are capable of?

Ans. I have.

Cross-int. 56. I think you have stated that in Model 5, as it
309 stands, the pattern could be repeated at 2, 4, and 8 picks. Am I right in that?

Ans. You are, if you add to your statement that you must have additional changeable segments and insert them in their proper positions in each of the cams.

Cross-int. 57. Can you repeat at 2, 4, and 8 picks with the model A, as it now stands, without any alteration?

Ans. In Model A, as it now stands, as far as I now see, the balls or rollers in the chain are so arranged as to repeat at every fourth pick and again on the eighth. You cannot repeat at the second pick without changing the arrangement of the balls or rollers.

Cross-int. 58. Why not?

Ans. Because you can't without changing the arrangement.

Cross-int. 59. Suppose you were to attempt to repeat at 2 picks without any alteration, what would be the result?

Ans. The result would be that without any change in the arrangement of the balls you couldn't do it.

Cross-int. 60. Your weft thread would go through the warp threads, would it not, if you attempted to repeat at 2 picks, and if yea, what would be the effect as to the fabric produced by such an attempt?

Ans. Yes, if the shuttle was moving properly and had yarn on the cop. The effect would be, if you didn't change the arrangement of the rollers, that the fabric would have a pattern repeated at every fourth pick.

Cross-int. 61. Can you tell how many patterns could be woven in a loom like Model 5, with no alterations except changing the sections or pieces, which you call cam rims?

Ans. I can't at present. There would be a great number.

Cross-int. 62. Could there be, in your judgment, more than a thousand?

Ans. There might be more than a thousand, or more than two thousand, but each pattern must repeat itself after every eighth weft thread.

Cross-int. 63. If by the use of such mechanism as is represented in Model 5, you should wish to repeat at 3 or 6 picks, you would
310 have to increase the capacity of the mechanism therein, which dictates what bars are to be moved to move the heddles, would you not?

Ans. I should not call it increasing the capacity. The fact is that you would have to have new cams, new and differently shaped sectors for each of the cams, and new cog gearing to drive them. If such changes can be termed simply increasing the capacity, then by such increase of capacity you could repeat at 3 or 6 picks.

Cross-int. 64. By what and in what manner are the bars or jacks which move the heddles in Model A attached to any other part of the loom?

Ans. By wires leading to the bottom levers and rods, which are parts of the jacks, to the upper levers. The rods have a pin through them and the upper levers, and the wires are fastened to pieces of metal which are hinged by a pin to the lower levers, forming a sort of hinged joint.

Cross-int. 65. By what and in what manner are the bars which move the heddles through levers, in Model 5, attached to any other part of the loom?

Ans. By wires leading upwards to the upper series of heddle levers, and downwards to the lower series, the ends of the wires in both cases passing through the holes in the ends of the levers and making a sort of hinged joint. One end of each of the bars also rests upon a pivot shaft attached to the frame of the loom, the arrangement being such that the bars can swing up and down upon that shaft when moved by the cam protuberances.

Cross-int. 66. Do the cam rollers in the pattern chain of Model A dictate the jacks or bars to be moved by pressing against the side of said jacks or bars?

Ans. By pressing against the sides of the said jacks, or retiring away from the sides of them.

Cross-int. 67. Do not the pieces which you call the rims of the cam, in Model 5, dictate what bar is to be moved by pressing against the sides of them?

Ans. They dictate which are to be moved, and simultaneously move them by bearing upon rollers attached to the sides of the bars.

Cross-int. 68. When a cam roller of a pattern chain in Model A
311 dictates which bar or jack is to be moved by bearing against it, it swings that bar or jack upon the joint when it is attached to an upper heddle lever, does it not?

Ans. It does.

Cross-int. 69. When one of the pieces in Model 5, which you call cam rims, dictates which bar is to be moved to move a heddle by pressing against the roller on that bar, it swings or turns the bar on the hinged joint at one of the ends, does it not?

Ans. When it both dictates and moves the bar so as to move the heddle, it swings the bar upon the stationary pivot shaft attached to the side of the lever frame.

Cross-int. 70. In Model A, do the parts which dictate what jack or bar is to be moved act upon more than one of the jacks or bars at a time?

Ans. Yes, they do; but each ball or cam acts only upon its own jack.

Cross-int. 71. Does any one of the cam rollers of the pattern chain in Model A act upon more than one jack at a time?

Ans. No.

Cross-int. 72. Does any one of the sections of the cam rims in Model 5 act upon more than one roller of a bar at a time?

Ans. No.

Cross-int. 73. In Model B does the lifting mechanism ever become the depressing mechanism in the operation of the loom?

Ans. No. I suppose you mean the vibrating lifter which lifts the jacks.

Cross-int. 74. How is that in Model A?

Ans. In Model A, the face of the bar which is lifting mechanism at one pick, is depressing mechanism at the next pick.

Cross-int. 75. How is that in Model 5?

Ans. In Model 5 one of the inclined parts of the groove leading from the outer to the inner periphery of the cam rim always acts to lift the particular heddle belonging to that cam, and the other inclined groove to depress that same heddle.

Cross-int. 76. How many motions has the mechanism in Model B which dictates what jack or bar is to be moved?

312 Ans. As I have already stated, I think more than once; the pattern chain in Model B has two motions, one upwards and downwards, and the other rotary upon the axis of the pattern chain prism.

Cross-int. 77. How is that in Model A?

Ans. One motion in a curvilinear direction.

Cross-int. 78. How is that with the part in Model 5 which dictates what bar is to be moved?

Ans. The part of the cam in Model 5 which dictates the motion of and moves the bars, the two motions being simultaneous, moves in a curvilinear direction only—that is to say, it moves exactly as a cam protuberance does in any revolving cam.

Cross-int. 79. I think you have stated that in Model A one lifter and depresser is common to all the jacks. Please state whether it acts upon all the jacks at any time, or only one at a time.

Ans. They act at the same time upon all the jacks that the pattern chain may select to be lifted or depressed.

Cross-int. 80. Is that, in the operation of Model A, only one at a time, or more?

Ans. More.

Cross-int. 81. Does the part of the lifter which acts upon one jack ever act upon any other jack in Model A?

Ans. The upper face of the lifter acts at times upon all the jacks, but each particular part of that face only acts upon the jack shoulder which this opposite to it.

int. Cross-int. 82. You say that in Model A the cam rollers of the pattern chain select or dictate what jacks are to be moved. I wish you to explain precisely what such rollers do to so select or dictate, and all that it is necessary for one of those rollers to do to so dictate or select.

Ans. One of the rollers on the pattern chain bears against a jack, selecting it out of the pack of jacks and moving it sidewise without moving the heddles against the force of a spring; when that roller retires from the jack and no roller follows it in succession, the force of the spring throws the jack back again also, without moving the heddles, into its former position.

313 Cross-int. 83. Does or not the roller hold the jack pressed back for some length of time?

Ans. It does.

Cross-int. 84. Is such holding included in what you mean by dictating which jacks shall be moved?

Ans. Well, hardly included within it. The holding follows immediately after the selection.

Cross-int. 85. Please specify then where such dictating or selecting commences, and where it ends.

Ans. Strictly speaking, the selection commences as soon as the roller commences to bear upon the jack, and ends when it has moved it to its full extent sidewise. The holding then commences and continues till the roller commences to retire, and the jack commences to be moved back again by the spring. There is then another holding by the spring until another cam roller acts upon the jack.

Cross-int. 86. Why is not the selection of the jack by the roller complete as soon as the roller comes in contact with the jack?

Ans. Because it is then still in line with its fellows and is not selected at all.

Cross-int. 87. Why is not the selection of the jack by the roller complete as soon as the roller has pushed the jack out of line with its fellows, and before it has moved it back to its full extent?

Ans. Because it has not up to that time made a selection of the jack as profitable for any use in the loom. If that was the end of the selection, the loom could not work.

Adjourned to Monday, 18th inst., at 9½ o'clock.

MONDAY, *Feb.* 18.

Cross-examination resumed:

Cross-int. 88. What holds the jacks down in Model A?

Ans. The lower tier of latches.

Cross-int. 89. Why don't the wire which connects the jack with the lower heddle lever pull the jack off the latch when the jack is down?

314 Ans. On account of the connection of the jack with the upper lever, and the abutment of the cam rollers of the pattern chain against the jack.

Cross-int. 90. In the operation of Model A, what may be the largest number of picks during which a jack is held down?

Ans. With the pattern chain arranged as it now is in this model, two picks.

Cross-int. 91. During how many picks might a jack be held down by adding or changing the position of the roller cams, without increasing the length of the chain?

Ans. Seven.

Cross-int. 92. What would hold the jack back upon the latch during that time?

Ans. The succession of cam rollers on the chain in connection with the attachment of the jacks to the top levers.

Cross-int. 93. During what part of that time would the cam roller which pushed the jack back hold it back?

Ans. It is for a part of one pick, including the time during which the shuttle is thrown.

Cross-int. 94. What relieves the cam roller which pushes the jack back from the duty of holding the jack back before the jack is again moved?

Ans. Supposing the jack is to move up the next pick, then the motion of the chain relieves it before it is moved; supposing it is to stay down for several picks, then the motion of the chain bringing successive rollers

into operation, relieves the roller that pushes the jack back, the rollers themselves being the active agency in relieving the preceding one.

Cross-int. 95. Do you consider that when a cam roller on the chain merely holds the jack back after it has been pushed back by another cam roller, it performs the office of selecting that jack to be moved?

Ans. It does not perform the office of selecting it to be moved.

Cross-int. 96. By so holding only, what office or function does that cam roller perform?

315 Ans. It keeps the shoulder of the jack under the latch, forcing the heddle belonging to that jack to be held up for the proper weaving of the pattern.

Cross-int. 97. What do you mean by "for the proper weaving of the pattern?"

Ans. I mean, in the relation I spoke of it, that if that heddle were not held up, there would be an error in the pattern to be woven at that time.

Cross-int. 98. Take a case where a jack is held down seven picks, as mentioned in your answer to the 91st cross-interrogatory, how many cam rollers would participate in holding a jack back under the latch during those seven picks?

Ans. Seven.

Cross-int. 99. What would be the function of the second one in the performance of that duty?

Ans. To hold the jack under the latch to keep its heddle up for the second pick.

Cross-int. 100. What would be the functions of the third, fourth, fifth, and sixth?

Ans. The same as the second, for different picks in succession.

Cross-int. 101. In Model A, why are the jacks, or the rods extending up from the jacks, curved backward on the edges where the cam rollers act upon them?

Ans. So that that part of the jacks, measuring up and down between the shoulders, may move up and down in substantially straight lines.

Cross-int. 102. What would be the effect of making that curve, say half the length it is as represented in the model.

Ans. Without knowing whether that half length is to be of greater or less radius than the present curve, or how it is to be located in reference to the shoulders and the point of pivot of the top of the jacks, I can only say that it would probably cause the jacks to chatter on the lifter and depresser. The curve now in the front edge of the jacks in the model is, judging by the eye, about twice the necessary length, that is to say, only about one-half the length of the curve is brought into action.

316 Cross-int. 103. Look at Plate 3, Fig. 4, of the drawings of the reissued Marshall patent, and state how the length of the curve represented there corresponds with the length of the curve of Model A, and also the length of the curve on the jack rods in the Marshall loom at Worcester.

Ans. It is difficult to determine with precision in this drawing where the curve begins and where it ends, but the curved part is evidently considerably shorter in proportion in the drawing than in the model. I do not remember as to the length of the curve in the jacks of the loom at Worcester, having stated before that what I did look at was to see whether the jacks, in consequence of that curve, moved up and down in substantially straight lines.

Cross-int. 104. Do you remember whether or not the curves in the jack rods in the Marshall loom at Worcester are greater or less than the curve represented in the drawing referred to?

Ans. I do not.

Cross-int. 105. State whether or not the wheel represented by f^1 in Fig. 2, of Plate 2, of the patent, is of the same size in proportion to the other parts in the Marshall loom in Worcester, as is represented in that drawing.

Ans. No. The wheel is a little larger in proportion, judging by eye, than that shown in the drawing. In that respect the loom corresponds exactly with Model A.

Cross-int. 106. What is the effect of so changing the proportional size of that wheel f^1?

Ans. To cause the lifter and depresser to act as they ought to act, as is evident not only from the patent as a whole, but also is derivable from a knowledge of looms existing prior to the patent, viz., that the lifter shall strike the jack shoulders at the same time relatively to the motion of the other parts at each pick of the loom. In the drawing there are represented fourteen links in the lifter and depresser chain, and four spurs on the cylinder that moves it, and this construction exists both in Model A, and in the loom at Worcester, and renders it necessary that the cog-wheel referred to should be about two-sevenths larger in diameter than the wheel into which it gears. If there happen to be sixteen links in the chain, the two wheels must be of the same diameter.

317 If eighteen links, the wheel f^1 must be one-eighth smaller than is shown in the drawings in proportion.

Cross-int. 107. Did you know of any loom prior to the Marshall patent wherein the same pieces became alternately a lifter and depresser for jacks?

Ans. No; I do not. But I do know of looms with lifters and depressers which are always in the same position in reference to the jack shoulders at each beat of the lay or pick.

Cross-int. 108. Could you not remove from Model A the pattern chain and the drum which carries it, and substitute therefor the mechanism represented in Model No. 5 for moving the bars which move the heddles, and have the loom work, supposing motion at the proper time to be imparted to the mechanism thus substituted, and supposing also, if necessary, that you add a piece or pieces to connect said mechanism with the jacks, or to impart motion from such mechanism to the jacks?

Ans. I think that if you were to make the cams in Model 5 of the proper size and apply them by means of upright swinging levers, having rollers taking into the cam-grooves, and pivoted connections to the jacks, and supports for the ends of those pivoted connections nearest the jacks, and slots for the jacks to slide through such connections, and a proper curve of both the front and the back of the jack-rod, that the thing could be done, and that the cams would then act as a pattern mechanism to select the jacks in connection with the lifters and depressers now in the loom to lift and depress them.

Cross-int. 109. Look at the drawing marked "Defendants' Exhibit 11," now shown you, and state what it appears to you to represent.

(Objected to.)

Ans. The drawing has writing on it, saying what the design is meant to represent. It does show the cams of Exhibit No. 5, applied to act so as to select the jacks of Model A, by means of a slide and two rollers, and in such a manner as, in my opinion, would be entirely impracticable in a loom.

Cross-int. 110. Why do you think it would be entirely impracticable in a loom?

318 Ans. Because the cams in their revolutions would either jam the slides in their guides and break them, or soon wear them out.

Cross-int. 111. Why do you think the cams would jam the slides?

Ans. Because I have seen attempts made before, if I am correct in my recollection, in which it has been attempted to work slides in guides by means of cams, and, from my general knowledge of mechanics, I think that the angles and relation of the parts are such that the effects I have stated would follow, especially in apparatus moving so rapidly and with so great jar and tremor of all the parts as is customary in working looms.

Cross-int. 112. As represented in drawing Exhibit 11, how do you understand the slides to be connected with the cams?

Ans. By rollers attached to one end of them running in the cam groove.

Cross-int. 113. Do you understand those rollers to be attached to the sides of the slides?

Ans. I do.

Cross-int. 114. Explain anything that you may think of, from which you conclude that the cams would jam the slides and which would not be equally applicable to the use of the bars in Exhibit 5.

Ans. Because in Exhibit 5 there are no slides at all, no guides around them, and the bars move on a pivot and in arcs of a circle and not in straight lines, viz., in the manner that I proposed to move the swinging levers when saying how the cams of No. 5 might be applied as a pattern mechanism in connection with the jacks of Exhibit A.

And in answer to direct interrogatories resumed by Causten Browne, esq., deponent saith:

Int. 20. After your examination of the Marshall loom at Worcester, as testified by you on your direct examination, was it examined in your presence by any person or persons connected with the defence? If yea, state when such examination took place and what gentlemen were present.

319 Ans. It was examined on the afternoon of February 11th, and the morning of February 12th, by Messrs. Ball, E. S. Renwick, and Treadwell, and on the morning of the 12th by Mr. Thomas.

Int. 21. I do not understand you to have stated distinctly in your direct examination what would be the effect of making that part of the jack rod on which a roller bears straight or substantially straight. Will you please do so now?

Ans. It would cause the shoulders on the jack to slide inwards and outwards on the lifter and depresser (which I term chattering), and perhaps sometimes to fall or be pulled off. This chattering would cause wear of the parts and some additional tremor in the working of the loom.

Int. 22. Would it or not produce a liability to displacement of the jacks in the working of the loom?

Ans. That is what I meant when I said that it might cause them to fall or be pulled off of the lifter and depresser.

Int. 23. In your answer to the 92d cross-interrogatory you said that during a certain number of picks in the operation of Model A, the jack will be held back upon the latch by the succession of cam rollers in the chain in connection with the attachment of the jacks to the top levers.

Is it or not, in your opinion, essential to the operation of the Marshall loom that the jacks should be connected with the lower heddle levers?

Ans. It is not.

Int. 24. Why not?

Ans. Because you might replace the connection between the lower ends of the jacks and the lower heddle levers, when taken out of the loom, by a direct connection independent of the jacks between the lower and the upper levers. If you then applied a spring behind each of the jacks, as in some modifications of the Thomas loom, the loom would work as it now does in the precise form exhibited in the model.

Int. 25. Will you produce a drawing showing such a modification of the Marshall loom as you have just described?

Ans. I produce such a drawing marked "Exhibit N, N. A. P., Ex'r."

320 Int. 26. In your answer to the 7th cross-interrogatory, you say there is nothing except the evener in the Marshall loom which holds the jack and the leaves of heddles in their extreme position up or down during the passage of the shuttle through the warp (I mean the Marshall loom which you saw at Mr. Crompton's factory at Worcester). Is it or not, in your opinion, essential to the working of that loom that anything should hold the heddles in their extreme position during the passage of the shuttle?

(Objected to.)

Ans. It is not necessary, because the loom, I think, would work with a smaller shed; then the heddles would be held in a position nearer the centre of the shed by the latches while the shuttle was being thrown.

Int. 27. In your opinion, will or will not the Marshall loom which you saw at Worcester work with the evener removed therefrom, and with a change of size of some part of the loom? If so, will you explain what such change should be?

Ans. I see only one difficulty in that loom working without the evener, and even that one may not exist in practice. The difficulty is that the jacks might slip off the lower latches during the time in which the pattern chain is shifting from one protuberance to the next protuberance immediately in succession. During that time the jack retreats slightly from the side of the loom, and is forced back again. Under the precise proportion and arrangement of parts shown in the drawing, the shoulder might perhaps slip off at the time spoken of, thereby causing the warp thread to trap the shuttle or the loom to make a mispick. This liability to unlatch might be obviated entirely by making the cam rollers larger in proportion, and the latching shoulders of the jacks a little larger, or by adjustments of the parts, viz., latches, shoulders, and lifter and depresser, to produce the same effect.

Int. 28. In your cross-examination you were asked whether or not in the Marshall loom at Worcester the spaces between the prongs of the jack, compared with the lifter and depresser chain, were in the same proportion as they are represented in the drawings of the Marshall patent. Will you state whether you find in the specification ac-

321 companying those drawings any directions, general or particular, serving to assist the workman in determining what such spaces should be; if yea, what?

Ans. I do. On the 24th page of the printed record, on the 3d and following lines, I find these words: "The jacks g are all of them forked at their lower ends, as represented in Figure 4, the two prongs being parallel and at such distance apart as to admit of the free working of the elevators and depressers l k between them." On the 24th, 25th,

and 26th lines of the same page I find these words: "The distance between the prongs of the jacks is such that the bars l k cannot strike the shoulders on the two prongs at the same time." And on the 16th, 17th, and 18th lines of same page are these words: "They will strike the shoulder h of the outer prongs of the jacks to depress them, and while moving up they will strike under the shoulder h of the main prongs to elevate them."

Int. 29. In your cross-examination you were asked whether or not in the Marshall loom at Worcester the range of motion of the lifters and depressers was in the same proportion to the distance between the upper and lower series of spring catches as is represented in the Marshall patent, and particularly in the drawings thereof. Will you state whether you find in the specification accompanying those drawings any directions, general or particular, serving to assist the workman in determining what such range of motion should be? If yea, what?

Ans. I have already read a statement stating that the lifters and depressers depress and elevate the jacks, and there is another statement to the same effect on page 25, lines 19, 20, 21, 22, and 23, showing that such elevation and depressing of the jacks forms the shed; and on the same page 25, lines 32, 33, 34, 35, 36, 37, and part of line 1st on page 26th, define the position of the two series of latches or catches. On page 22d there is a statement on lines 11 and 12, which shows that the latches are to be so placed as to hold the jacks in their elevated or depressed positions.

Int. 30. You state in answer to 106th cross-interrogatory that the effect of changing the proportional size of the wheel f^1 shown in
322 the Marshall drawing is "to cause the lifter and depresser to act as they ought to act, as is evident not only from the patent as a whole, but also," etc. Explain how this is evident from the patent as a whole.

Ans. It is evident from the patent as a whole, and especially on lines 15 to 23, inclusive, of page 24, that the lifter and depresser control the opening of the shed, and, in fact, open the shed. In order to do so properly, they must, as in other looms, commence to act upon the jacks at a given time during each revolution of the crank-shaft and the cog-gearing must be so proportioned as to cause them to do so, and not commence shifting the shed while the shuttle is traversing the warp, which they might at times do with 14 links to the depresser chain and bevelled cogs all of equal size.

Adjourned to 2½ p. m.

Resumed:

And in answer to cross-interrogatories by Geo. Gifford, esq., deponent saith:

Cross-int. 115. Look at the second paragraph of the Marshall specification, as contained on the 25th page of the printed record, commencing with line 4 and ending with line 18 thereof, and state whether you find there the description or statement of the range of motion of the lifters and depressers relatively to the distance between the upper and lower latches?

Ans. I do not.

Cross-int. 116. What do you understand to be explained by that paragraph?

Ans. I understand to be described in that paragraph the action of the roller cam on the jack, and the consequent action of the depresser,

and also how successive cams act upon the chain; and further, the selection caused by the absence of a roller on one link of the chain, and the consequent elevation of the jacks.

Cross-int. 117. Do you understand that there is any condition of
323 the jacks and the elevating and depressing bars, referred to in that paragraph, in which the shoulders both on the outer and inner prong of a jack are at the same time out of the reach of the lifting and depressing bars, so that the lifting and depressing bars might rotate without acting upon either shoulder of that one jack?

Ans. I do not understand that in that paragraph there is any such condition stated.

Cross-int. 118. What do you understand is the relative position of the lifting and depressing bars when, as stated in that paragraph, such of the jacks as are depressed and are opposite to a portion of the pattern chain, which for the time being has no roller cam on it, will be drawn outward by the tension of the oblique rod so that the shoulder of its inner prong will be acted upon by one of its bars?

Ans. The lifting bar is then just lifting a jack, and the depresser is just depressing any jack that may have been selected for that purpose.

Cross-int. 119. What, then, do you understand to be the meaning of the following language as used in that paragraph: "But if at such time the jack be in a depressed position, the bars (*l k*) will not act on it?"

Ans. That the bars (*l k*) will not act on it for any useful purpose—they will hit it a little rap, knocking it away from the latch and let it fly back again.

Cross-int. 120. What do you understand to be the meaning of the following language used in that paragraph: "And the shoulder (*h*) of the inner prong is beyond their reach?"

Ans. I understand to be meant that the shoulder (*h*) is so far over towards the side of the loom that the elevator won't hit it.

Cross-int. 121. In your answer to 26th direct interrogatory, you give it as your opinion that the Marshall loom would work to a certain extent without an evener—that is, as you there say, with a smaller shed the heddles would be held in position nearer the centre of the shed, by the latches, while the shuttle was being thrown; how small a shed do you mean, and why would having a smaller shed make a difference?

324 Ans. I didn't say that having a smaller shed would make any difference, and don't think it would. The shed would be about of an inch less wide open, measuring from top to bottom, than it is when the heddles are held in their extreme positions by the evener.

HENRY B. RENWICK.

Deposition of Henry Wyman (recalled), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 15, 1867.

Int. 1. Since your examination on Wednesday last, have you operated the Marshall loom in Mr. Crompton's factory at Worcester, with the evener removed therefrom?

Ans. I have.

Int. 2. In dispensing with the evener, what adjustments of other parts of the loom, if any, did you make?

Ans. I cut off about $\frac{1}{16}$ of an inch of the lifter and depresser each—off of the outer sides of them, I mean. I moved the inner latches out about the same distance, and also moved the top levers outward about $\frac{1}{8}$ of an inch. The outer set of latches were adjusted in a different posi-

tion from what they were before. I don't remember exactly how, but I know I moved them a small distance—a trifling distance. I made the evener rolls a little smaller in diameter. That was not necessary to operate the motion for running without the evener; it was to have the loom prepared to run with the evener in connection with the adjustments which were made to run it without the evener, if desired.

Int. 3. Did you weave cloth upon the loom with the adjustments you have mentioned and without the evener?

Ans. I did.

Int. 4. How much?

Ans. About a yard and a half.

Int. 5. Is the loom now standing without the evener and ready to weave cloth?

Ans. It is.

325 (The counsel for the complainant here gives notice to the counsel for respondents that they with their experts and clients can inspect the loom and see it operated in its present condition, at any convenient time.)

Int. 6. How was the operation of the loom without the evener; satisfactory or unsatisfactory?

Ans. It was satisfactory.

Int. 7. At what speed did you run it?

Ans. At the same speed as with the evener on the previous trial.

Int. 8. Did you at any time before the Arlington Mills were destroyed by fire go there and examine the Marshall open-shed loom so called? If so, when?

Ans. I did; it was about September 8th, 1866.

Int. 9. At whose request?

Ans. At Mr. Crompton's.

Int. 10. Did you take notice of the formation of the jacks at the place where the rollersof the pattern chain bore upon them? If so, what did you observe the formation of the jacks to be?

Ans. I did; I observed that they were straight, or nearly so.

Int. 11. Had you before going there had your attention drawn to the question of the formation of the jacks in that particular, as affecting the operation of the loom? If so, how?

Ans. I had, in building the model of the Marshall loom (Model A), and also in building the Crompton open-shed looms previously to that time.

Int. 12. When you ran the Marshal loom at Worcester without the evener, was the shed reduced, and how much?

Ans. I should say it was reduced in size about half an inch, judging by my eye, without measuring it.

Int. 13. Will you look at "Exhibit O," and state whether it consists of a batch of samples of fancy woollens?

Ans. It does.

Int. 14. I observe that on each of these samples there is a label giving such and such a number of chain bars or bolts, and such and such a number of harnesses. State, if you know, what such labels signify in each case.

326 Ans. The number of chain bars stated represents about the number of picks which it takes to repeat the pattern on each, and the number of harnesses designated in the pattern represents the number of harnesses which it takes to weave that pattern to which the label is attached, as near as I can judge without picking to pieces each pattern separately. I have examined two of them, and know that they are correct, and should judge the others to be so.

Int. 15. Does each of those patterns require, in order to weave it, the numbers of bars of chain labelled upon it? Is that what you mean by its taking that number of picks to repeat the pattern?

Ans. It is.

And in answer to cross-interrogatories by Geo. Gifford, esq., deponent saith as follows, viz.:

Cross-int. 1. You say you cut off about one-sixteenth of each lifter and depresser on the outer sides; what did you do that for, and what was the result of it?

Ans. The object and result both was so to adjust the jack that when two balls on the pattern chain came into operation one after the other consecutively the prong on the jack, which holds it in a depressed position, should not unlatch from the catches or latches which so hold it.

Cross-int. 2. You say you moved the inner latch outward about the same distance? What was the object and result of that?

Ans. That was for the purpose of holding the jack in a depressed position in connection with another alteration which I did not state in the direct examination, which was to move the chain cylinder about one-sixteenth of an inch, I should judge, from its previous position (which escaped my memory in the direct examination).

Cross-int. 3. Why did you move the top levers outward about one-eight of an inch?

Ans. After making the alterations previously stated, I found that the top levers required to be moved outward about one-eighth of an inch in order to have the prongs of the jack which the lifter and depresser operate upon move up or down parallel with the lifter and depresser.

327

Cross-int. 4. Why was the shed smaller after these alterations?

Ans. Because the evener not being in operation, allowed the hooks to rest directly upon the latches, and I think the outer set of latches was moved downward a little to insure the safe delivery of the prongs of the jacks upon them.

Cross-int. 5. You say you cut off of the outer sides of each of the lifters and depressers so that when two balls on the pattern chain came into operation consecutively the prong on the jack which holds it in a depressed position should not unlatch from the catches or latches which so hold it. In the operation of the loom does it not sometimes happen that when one of the balls on the pattern chain leaves a jack, it is followed by a space on the pattern chain towards the jack instead of another ball?

Ans. It does so happen sometimes.

Cross-int. 6. Does that not sometimes happen when you want the jack to still remain longer in a depressed or elevated position?

Ans. I don't understand the question.

Cross-int. 7. Is there always a ball or balls holding the jack back as long as you want the jack to remain in a depressed position?

Ans. There is after it is once down.

Cross-int. 8. Then no space where there is no ball on the pattern chain passes opposite that jack which is so down as long as you want the jack held down? Is that so?

Ans. There is no space on the pattern chain passes opposite the jack during the time it is required to be held down.

Cross-int. 9. When did you commence the alterations upon the Marshall loom for the purpose of trying it without an evener which you have specified.

Ans. I commenced on Thursday morning last—four days ago—and worked on it during what leisure time I had to spare from my other duties at the shop, and completed it the next forenoon—Friday.

Cross-int. 10. When and where did you first see "Exhibit O?"

328 Ans. A part of them I saw here to-day for the first time, and part I saw some day last week.

Cross-int. 11. Do you know of your own knowledge what the numbers on the labels attached to those samples indicate?

Ans. I do, in two instances.

Cross-int. 12. Specify which two.

Ans. Those marked with a red cross. I have not examined these two so closely as a designer would to mount them for a loom, but I am confident that the marks of them are correct or nearly so.

Cross-int. 13. Do you know where those two specimens marked with a red cross were woven?

Ans. I do not.

Cross-int. 14. Do you know where any of the specimens in "Exhibit O" were woven?

Ans. I do not.

Cross-int. 15. Do you know what loom or looms they were woven on?

Ans. I do not.

Adjourned to 9½ a. m., 19th Feb., 1867.

FEB. 19, 1867.

Examination resumed:

Cross-int. 16. Were the alterations which you enumerated yesterday as having been made in the Marshall loom to make it work without an evener all the alterations or changes of any kind whatever which you made in it for that purpose?

Ans. They were.

Cross-int. 17. In that loom suppose a blank space on the pattern chain succeeds a ball opposite a jack which is down, or that a ball on the pattern chain succeeds a space opposite a jack which is up, are not such jacks detached from the spring-catches that hold them?

Ans. They are. They must necessarily be so before being thrown over the lifter or depresser.

Cross-int. 18. What then, in that case, prevents them from mov-

329 ing towards their central positions under the tension of the warps so as to close, or partially close, the shed?

(Objected to.)

Ans. I don't know of anything that prevents them.

Cross-int. 19. If nothing prevents them from so moving, do they not so move?

(Objected to as not correctly stating the testimony.)

Ans. I think it depends on the speed the loom runs.

Cross-int. 20. Please explain how and why it depends upon the speed at which the loom is running.

Ans. The speed of the loom and consequently the velocity of the lifter and depresser may be such that they would overtake and carry the jacks into their positions.

Cross-int. 21. Then to prevent the jacks in such case moving towards their central positions under the tension of the warps, it is necessary to run the loom at high speed; is it not?

Ans. I do not know. It is necessary to run it fast enough to fulfil those conditions stated in my previous answer. I cannot state that it would be high speed, not having investigated it.

Cross-int. 22. Do you know how high the speed would have to be for that purpose?

Ans. I do not.

And in answer to direct interrogatories resumed, deponent saith:

Int. 16. In running the Marshall loom without the evener at the same rate of speed at which you run it with the evener, viz., 88 picks, did you have any difficulty from the premature closing of the shed or its trapping the shuttle?

Ans. I did not. The shed was just as clear as with the evener.

Int. 17. Was not the shuttle through the shed before the jacks were entirely unlatched?

Ans. It was. I judge so from the fact that there was no trouble from trapping the shuttle.

Int. 18. Since your examination yesterday, have you made a further inspection of the batch of patterns marked "Exhibit O," with
330 reference to the correctness of the numbers of bars of chain required for each, as marked upon each.

Ans. I have.

Int. 19 Will you now state in regard to those patterns other than the two about which you spoke positively yesterday, whether they, as well as the two mentioned, have the number of bars of chain required respectively, correctly marked upon them, and state your means of knowledge on th esubject?

Ans. They are correct, or within five or six bars of being so. It is impossible to be accurate with the method by which I examined them. I counted the number of picks per inch in each of about the same weight, then measured the length of the pattern woven, and calculated from that the number of picks in the pattern. The manner in which to arrive at absolute certainty would be to pick out each thread in the length of the pattern, and count the number of threads so picked out.

HORACE WYMAN.

(The defendants' counsel, in answer to the notice or invitation given on the record yesterday by the counsel for the complainant to the defendants, for their counsel and experts to visit Worcester and inspect and see operated there a loom which is called the Marshall loom, and which the witness, Wyman, testifies operates satisfactorily without an evener, answer that they will accept the invitation and visit Worcester for the purpose of examining said loom, if they shall be permitted to so use it or cause it to be used, and by their own operation, sufficiently to determine whether or not in its present condition it is a loom suitable for practical use; and to that end, if in their opinion it shall be necessary, they shall have liberty to cause considerable weaving to be done upon it, but not exceeding fifty yards; also to run the loom at different speeds, also to try such different warps and filling as are generally used for fancy weaving in manufacturing establishments. If the complainant will grant this, it is to be on condition that the defendants shall furnish all the material which they shall use or cause to be used in
331 testing said loom, or shall pay all the expense of the same, and also pay for all damage or injury, if any, which may be done to said loom, and for all expense of operating the same.)

Deposition of Hervey Waters (recalled), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 19, 1867.

Int. 1. Look at model now shown you and marked complainant's Exhibit D, in which there are depressions formed in the periphery of the

sector for the friction-brake to drop into when the sector is at its two extremes of motion, and suppose Model B had all its sectors made like that shown in this Model D, would Model B, when so altered, have substantially the same combination of jacks, lifter and depresser, pattern mechanism, heddles, and holding mechanism for the purposes of those parts in the Marshall loom that it now has, or substantially a different one?

(Objected to.)

Ans. It would be the same.

Int. 2. Will you state briefly your reasons for that opinion?

Ans. The mode of operation of the machine would not be changed, except so far as to make the holding of the sectors more positive at their extreme limits of action, if the springs upon the brakes had the same tension as before the depressions were formed. Or, in other words, and otherwise considered, with these depressions for the brake, the springs might have much less tension and the brake still answer its purpose.

Int. 3. Suppose the concentric portions of the slots in the sectors of the loom model B, to be removed therefrom, or the loom to be run with so small a shed that those concentric portions are not brought into action to hold the leaves of heddles up or down, and suppose the leaves of heddles are so held, maintaining the open shed, by means of the friction brakes applied with sufficient pressure against the peripheries of the cam sectors, would the loom model B, when so altered or when so operated, have substantially the same combination of jacks,
332 lifter and depresser, pattern mechanism, heddles, and holding mechanism for the purposes of those parts in the Marshall loom that it, the said loom model B, now has, or a substantially different one?

(Objected to.)

Ans. Substantially the same.

Int. 4. State briefly your reasons for that opinion.

Ans. The shed would still be held open by the sectors just as before, except that it would be necessary to increase the friction upon the sectors that the sectors might not be moved by the tension of the warp and the strain of the parts acting to produce motion upon the sector by the pressure of the roller upon the shifting concentric surfaces which would then be the holding surfaces of the locking.

Int. 5. Please look at the sketch now shown to you marked "Exhibit E, N. A. P., Ex'r," and say whether if sectors and springs like those shown in that sketch as explained at page 165 of the record were substituted for those now shown by Model B, it, Model B, would then in your opinion contain substantially the same or substantially a different combination of jacks, lifter and depresser, pattern mechanism, heddles, and holding mechanism, as said Model B now does, for the purposes of the loom?

(Objected to.)

Ans. Substantially the same, but I do not think it would work as well as if the friction of the brake were still maintained between the locking points on the sector, as would be the case, providing the periphery of the sector were far enough from its axis to come to a bearing upon the elliptic springs in the passage of the sector by and upon them.

Int. 6. Suppose the spring latches to be removed from Model A, and brakes to be applied, with or without notches, to the peripheries of the collars through which the upper series of heddle levers pass, being the construction exhibited in model now shown you marked "Exhibit F," and state whether in your opinion the combination of jacks, lifter and de-

presser, pattern mechanism, heddles, and holding mechanism, would be substantially similar to, or substantially different from, that now shown in Exhibit A, for the purposes of the loom.

(Objected to.)

Ans. With the notches I think it would be substantially the same; without the notches I think it would not be substantially the same.

333 Int. 7. Will you give your reasons for both these opinions?

Ans. With the notches there is clearly and decidedly a locking mechanism; without the notches it is not so clear either way. But I incline to the opinion strongly that for the purposes of a fancy loom working as Model A works, the friction alone would be hardly practical. It might be possibly practicable, but the weaving would be done, if it was done, under great difficulties.

Int. 8. Will you look at the loom model labelled "Defendants' Exhibit 5," and state what kind of loom that represents, and to what class of looms it belongs?

Ans. This belongs to that class of looms which I have in this case before denominated as twilled looms. It is a cam loom, as these twilled looms usually are; but instead of being made up with permanent cams, it is made up of changeable cams, and those cams may be so changed as to make it a cross to some extent between a plain-twilled loom and a fancy loom, the maximum of fancy figures which can be made upon this loom coming up to, and perhaps going a little beyond, the minimum of what is usually done in a regular fancy loom.

Int. 9. Will you compare the loom represented by Exhibit No. 5, and the loom described and represented in the Marshall reissue patent and exhibited in Model A, and say whether you find in the former substantially such a combination of jacks, lifter and depresser, pattern mechanism, heddles, and holding mechanism, as are described and represented in said patents for the purposes there specified, or a substantially different one? And give your reasons pretty fully.

Ans. I do not find the combination as inquired of; but I do find a substantially different one. In Exhibit No. 5 I find no jacks, no lifter and depresser, no pattern mechanism, and no holding mechanism operating for and in the manner of any parts in Model A. I do find a sort of lifter and depresser, a sort of pattern mechanism. I find heddles, and a sort of holding mechanism; but all their modes of operation are essentially different. The lifter and depresser in Model No. 5 is simply a treadle actuated by a cam; the pattern mechanism is simply

334 a congregation of cams; and the holding mechanism is simply the same cams holding by the heddles before referred to. In Model A the jacks have two distinct offices or functions; one is to be pointed out by the pattern chain and brought to the action of the lifter or depresser as the case may be; the other is to be acted upon by the lifter or depresser as the case may be. The lifter and depresser have always the same motion at every pick and common to every pick whether there be eight bars in the pattern mechanism or a thousand bars, and in such movements they act upon such jacks and such jacks only as are indicated by the pattern chain. The pattern mechanism in Model A has such a connection with the mechanism of the loom, and said mechanism is so arranged and contrived that by a mere change in the pattern chain, and without any change in the mechanism of the loom, the result of the pattern chain goes to the figure made in the loom, while in Model 5 any change in the form of mechanism of its cams for the purpose of changing its figure is dependent largely upon the construction of the loom itself so that no very considerable change can be made without chang-

ing essentially the organization of the loom. Take this instance: This Model 5, as the cam is now arranged and as the loom is now organized, cannot go beyond what eight bars will do in the pattern chain now on Model A. Now, if it were desirable to change both of these looms to 250 bars, or in other words to 250 picks in the entire figure before it returns upon itself, it would be necessary to make the cams of the loom as represented in Model 5 of some 30 times the diameter that would be necessary with eight picks, and it would be necessary to so gear up the loom that the crank-shaft which drives the lathe should have 250 revolutions to one revolution of the cam-shaft, instead of having eight revolutions as it now has; whereas with a loom constructed like Model A it is only necessary to put on a pattern mechanism suitably constructed and arranged, and, without any alteration in the loom, you are ready to go along. Now, after all these changes are made in a loom like Model 5, the loom would be good for nothing for any practical purpose, while such a change as I have mentioned for Model A would be such as is quite usual, the loom still being entirely practical.

Int. 10. What is the change you speak of in the pattern chain,
335 of such looms as those represented by Model A, which will enable them to weave a pattern which returns upon itself after a great number of picks, say 250?

Ans. The change is to take off the pattern chain having eight bars and put on one having 250 bars.

Int. 11. Will you now compare the loom represented by Model No. 5 with the loom represented by Model B, and state whether you find in the latter loom substantially such jacks, lifter and depresser, pattern mechanism, and holding mechanism as are shown in Model No. 5? And if you do not, state generally in what substantial respect they differ therefrom.

Ans. I believe the differences are the same as between Model 5 and Model B that they are between Model 5 and Model A, with the exception that in Model B in place of saying 250 "bars," I would say 250 cards.

And in answer to cross-interrogatories propounded to him by Geo. Gifford, esq., deponent saith as follows, viz:

Cross-int. 1. What device, if any, can you think of for holding the sheds of warp open which, according to your judgment, would not, as an element, come within the combination covered by the Marshall reissue patent?

(Objected to.)

Ans. I don't know what I could think of. Here is one now I do think of, represented in Exhibit F, where the friction brakes are used without notches. This device will hold the shed open I've no doubt, but whether it would come within that combination I very much doubt.

Cross-int. 2. In Model D, there is a depression on the periphery of a sector with a piece fitting into it, which piece is pressed to the sector by a spring. What kind of a device, if you can name it in general terms, does the combination of these three things constitute, to wit, the periphery of the sector, the spring, and the piece pressed upon the sector by the spring?

Ans. It constitutes a device for locking and unlocking.

Cross-int. 3. Do you know of any name, speaking mechanically,
336 for designating that device without reference to the particular purpose for which it is used?

Ans. No, I do not.

Cross-int. 4. Do those three parts in that combination constitute a latch?

Ans. I should say not. That's not the word I should use for it.

Cross-int. 5. How do you define a latch mechanically?

Ans. I'm sure I don't know how I define it mechanically. I know what is a latch. A door-latch is a latch, whether it be a common latch or a bolt latch. I believe it is more usual to name it that way, where the latch serves for holding in one direction only, by falling into a notch out of which it may be lifted.

Cross-int. 6. Is not the piece in Model D between the spring and sector, in or against a notch out of which it may be lifted?

Ans. Hardly.

Cross-int. 7. Why not?

Ans. Because that's not the way in which it is to be used.

Cross-int. 8. In which what is to be used?

Ans. The contrivance you are inquiring about.

Cross-int 9. Define it.

Ans. Define what?

Cross-int. 10. What you referred to in your last answer.

Ans. I referred to your second interrogatory in these words: "In Model D there is a depression in the periphery of a sector with a piece fitting into it, which piece is pressed to the sector by a spring." That is your contrivance, and I don't like to define it without considering its use. If you will take it in connection with a loom, as represented in Model B, I will then attempt to analyze it.

Cross-int. 11. I prefer to examine Model D by itself. Please tell us now what you mean by your answer to 7th cross-interrogatory.

Ans. I have no different answer to make to the question as it now stands, but if you will make your question apply to the whole of Model D as it stands, I shall be happy to attempt to analyze it.

Cross-int. 12. I prefer to put my questions in my own way, and again ask you to explain what you mean by your answer to the 7th cross-interrogatory.

337 Ans. What I mean by that answer is just what I refer to in my last answer before this; and it is this, that Model D, as it stands, has an intelligible idea contained in it as connected with the subject of weaving, whereas, in my judgment, such a contrivances as you have narrowed your question to admits of no intelligible answer. It is quite clear in Model D, that if the sector is to be turned by taking hold of it where teeth are formed upon it, it will be easy to see how the thing works, and I don't see any other way in which it can work. That does not embody any necessity of lifting the brake directly out of the notches or depressions.

Cross-int. 13. I now call your attention to the sketch, Exhibit E, and ask you to name it, if you can, as a separate mechanical device?

Ans. As a separate mechanical device, I think it may be termed a locking and unlocking mechanism.

Cross-int. 14. Does it contain a latch?

Ans. Hardly. If it had in connection with it a lever, with a roller working in the slot, it would then be more certainly a locking mechanism; and, for the purposes of locking that lever, it would be, the whole together, the equivalent of two latches for locking that lever at the two extremities of its movement.

(Adjourned until 2 p.m.)

Resumed:

Cross-int. 15. In your answer to the 8th direct interrogatory, in reference to Model 5, you say the maximum of fancy figures which can be

made upon this loom comes up to, and perhaps goes a little beyond, the minimum of what is usually done in a regular fancy loom. What do you mean by the maximum and minimum, as therein used?

Ans. I mean that I have never known more or heard of more than 24 picks in a figure, as practically produced by cam looms; and I do not think it is common to use a fancy loom much on figures less than those containing 8 picks to the figure.

Cross int. 16. Can you tell how many patterns Exhibit 5 would
338 weave with no other change or alteration than changing the cam sections on the eight wheels?

Ans. I cannot. That's a question for a weaver, I believe.

Cross-int. 17. Isn't it a matter of mathematical calculation, according to your judgment?

Ans. It is, but I am not familiar with the formula.

Cross-int. 18. According to your judgment, would the number be very large?

Ans. It would, as compared with eight, but it would not be very large as compared with 250, and the combinations that could grow out of the latter sum.

Cross-int. 19. Would not the number, according to your judgment, exceed 100,000?

Ans. I don't know as to that. It would be a mere matter of impression. As an impression, I should think it would not.

Cross-int. 20. Do you not believe the number would exceed one million?

Ans. No; I do not believe it, yet I know nothing about it.

Cross-int. 21. How many patterns will a loom like Model A, and with the pattern chain consisting of the same number of bars, and having the same number of cam-rollers as is represented in Model A, weave without any alteration except changing the position of the cam-rollers?

Ans. I can't answer that question; it is not within my knowledge.

Cross-int. 22. Would it, in your opinion, be a very large number?

Ans. I think it would be, as compared with eight.

Cross-int. 23. How do you think that number would compare with the number of different patterns which could be woven by a loom like Model 5, with no alteration except changing the position of the cam sections?

Ans. I don't think I am qualified to answer that question; still, I have an opinion. I think that more changes can be made on Model A than on Model 5. It is quite likely I am mistaken if the loom be confined to the precise pattern chain now on the model. I do know that
339 always keeping the loom the same much greater changes may be made on a loom like Model A than on one like Model 5, by merely changing the pattern apparatus.

Cross-int. 24. Why do you think, under the circumstances embraced in the last question, that more changes can be made on Model A than in Model 5? These conditions or circumstances were that the pattern mechanism in each is not to be altered except by changing the position of the cams that are now on them.

Ans. I don't think there could be any more changes made, as I know of, with those restrictions. I certainly do not know distinctly that there could be; and, with those restrictions, I incline to the opinion that there could not be any more.

Cross-int. 25. Now, if the pattern mechanism on Model 5 is capable of weaving as many patterns as is the pattern mechanism on Model A, and you wished to increase the capacity of Model 5, you would add more cams, would you not?

Ans. Will you be kind enough to tell me what you mean by cams in that question?

Cross-int. 26. I mean those pieces or sections of the pattern mechanism of Model 5 which act upon the small rollers attached to the bars, which bars give motion to the heddle levers, and which Mr. H. B. Renwick, in his deposition, has called cam rims. With this explanation, please answer the last question.

Ans. That's one thing I would do, but that wouldn't be enough; you would have to alter the gearing besides.

Cross-int. 27. If the pattern mechanism on Model A, as it now is, is capable of weaving as many patterns as is the pattern mechanism in Model 5, without any additional number of parts, in case you wished to render it capable of making still more patterns, you would add more cam rollers, would you not?

Ans. I would, and more bars for them in the chain; and that's all I would do, as I understand it.

Cross-int. 28. You would, in that case, also add more links or sections to the chain, would you not?

Ans. Of course you would, because the chain must be longer.

Cross-int. 29. You say in making an addition of cam sections to
340 Model 5, you would also change the gearing. What gearing would you change, and for what purpose?

Ans. The gearing which drives the cam from the lathe shaft, or which connects it with the lathe shaft, so that the cam should only revolve once while the lathe shaft rotated nine times or more, as the case might be, instead of eight, as it now does.

Cross-int. 30. Such change of gearing would be for the purpose of properly operating the increased number of cam sections, would it not?

Ans. It would; and such a change of gearing might serve for a small change beyond eight. If the change was considerable beyond eight, say as many as twenty-four, instead of eight, which would be sixteen beyond eight, it would be necessary to increase the size of the structure upon which the cams are set, and therefore necessary to have entire new cams throughout—say fifty-four inches in diameter.

Cross-int. 31. When increasing the pattern mechanism in Model A, by the addition of a link or links to the chain, as previously spoken of, it would be done for the purpose of properly operating additional cam rollers, would it not?

Ans. Ordinarily it would.

Cross-int. 32. What variety of fancy goods could a loom, constructed like Model A, with no additional parts, weave?

Ans. If the loom, constructed like A, be confined to the pattern chain now upon it, without addition or subtraction upon the pattern chain, it could only weave such variety of changes as could be made within eight picks to the figure, and perhaps not quite all of them. I don't know what the necessity of a chain might be for all the changes which can be made within that number, as to the number of rolls that should be used on each bar. I believe that one bar may be subtracted from the chain now on A, and thus reduce the variety which could be made on it.

Cross-int. 33. What variety of fancy goods could be woven on a loom like Model 5, with no additional parts?

Ans. As far as the loom is concerned, any variety of combinations, the same as I have said in regard to Model A, as long as it is confined to the number eight; but I believe that some additional parts
341 would be necessary in making up the cams, and I know that you could not subtract from the parts so as to make seven picks instead of eight.

Cross-int. 34. According to your judgment, would or would not a loom constructed like Model 5, without any additional parts, but by the use only of the parts which it contains, weave as many varieties of fancy goods as would a loom constructed like Model A, without any additional parts, but by the use only of the parts which it now contains?

Ans. I believe it would.

Cross-int. 35. You have said that the cams in Model 5 are changable, so as to make a loom like that model to some extent "a cross" between a plain twilled loom and a fancy loom. What do you mean by "cross" in that connection?

Ans. I mean that it approaches the qualities of the fancy loom. It is a hybrid, not reaching a distinct species.

Cross-int. 36. State, if you can, what you would have to take out of Model 5, so that it would weave, and not be capable of weaving fancy goods.

Ans. I don't know as you would have to take out anything. I think that perhaps, in order to weave a regular twill, it might be necessary to take out some of the sections in each cam; but I am not very clear on that.

Cross-int. 37. Are you willing to swear that to weave a regular twill you would have to take out some of the sections of the cams?

Ans. No, I am not; but I think you would have either to take out some or put in some, just which you had a mind to.

Cross-int. 38. Then your judgment on that subject is no better than that of any other man who don't know the fact, is it?

Ans. For the purposes of a positive answer to the question, it is not.

Cross-int. 39. What, in your judgment, makes Model 5 a hybrid or cross?

Ans. Because that, although it will do a little something as a fancy loom, it still has all the characteristics of a twilled loom.

Cross-int. 40. Specify all its characteristics as a twilled loom, in contradistinction to its characteristics as a fancy loom.

342 Ans. In the twilled looms, where a regular figure is produced to some extent, the cams are all alike usually, and so proportioned and placed upon the shaft as to always give the same appearance to all parts of the cloth; for instance, when the twill is made with three leaves, having one-third of the weft on one side and two-thirds on the other in forming the shed, changing at each pick regularly from side to side, and in regular succession one-third of the warp threads. An analogous relation is usually had, whatever the number of treddles. While in this loom, when used as a fancy loom, such an order of succession would not be made, and therefore the construction of these cams so as to be changeable. Now, I notice that in this Model 5 there are eight harnesses and eight cams. If the cams were so shaped, and so related to each other as to change one harness at a time at each pick of the shuttle, and the piece so drawn into the harness as at every pick such change would carry one-eighth of the warp from one side to the other at each pick, and in regular succession, as I have mentioned in the case of three leaves, the loom would work as a twilled loom with eight leaves. Now, supposing the drawing in of the warp in the harness to remain the same, and the cams to be so set as to change two leaves of the harness at once, from time to time, in regular succession, alternately, as I have mentioned in the first place, it would then be a twilled loom, having one-fourth of the warp upon one side of the shed, and three-fourths upon the other, at each pick of the shuttle. It would then work as a twilled loom, making ordinary kerseymeres.

Cross-int. 41. In the cam twilled looms that you have seen, are not the heddles connected in pairs with the cams, so that when one heddle goes up the corresponding one always goes down, both being moved simultaneously by the same cam?

Ans. I believe not.

Cross-int. 42. Are you sure not?

Ans. Pretty sure. There is in such chains always this condition, that when one leaf goes from one side to the other, a corresponding leaf is brought over from the other side to take its place (that is, corresponding as to quantity), and at about the same time, but not by the same cam, as I understand it. It is usually done by a cam, either positively or negatively.

343 Cross-int. 43. What do you think is necessary to entitle a loom to the dignity of being called a fancy loom?

Ans. A fancy loom must have the same substantial qualities as a Jacquard figured loom, with the exception that in a fancy loom the heddles are worked in leaves, while in the Jacquard figured loom each heddle may be worked separately.

Cross-int. 44. By what means and from what source did you receive that notion of what constitutes a fancy loom?

Ans. I'm sure I don't know that; I guess a good many sources.

Cross-int. 45. Was not the old Crompton loom a fancy loom?

Ans. Yes.

Cross-int. 46. You say that in Model 5 you do find a sort of lifter and depresser; what do you find therein which you call a sort of lifter and depresser?

Ans. I find what I have always called a treddle, and I find that treddle has upon it a roller, which roller works in a grooved cam. Now, this cam deflects the roller (which has its axis upon the treddle) in both directions, so as alternately to lift and depress the heddles according to the position of the cam as it revolves round its axis.

Cross-int. 47. You say that you find in Model 5 a sort of pattern mechanism; what do you find therein which you call a sort of pattern mechanism?

Ans. I find cams operating upon the treddle, as I have just before described, each cam actuating its own particular treddle, and no other. These cams are made changeable, so that they can be from time to time reconstructed, not only in themselves, but so as to change their relation to each other.

Cross-int. 48. Do you call changing the position of one of the cam sections, according to the theory of that loom, a reconstruction?

Ans. I do.

Cross-int. 49. Then is not changing the position of the cam rollers in the pattern chain of Model A, according to the theory of that loom, also a reconstruction?

Ans. Yes.

Cross-int. 50. Why is the mechanism which you referred to in Model 5 a sort of pattern mechanism?

344 Ans. Because it controls the figure to be produced.

Cross-int. 51. You say that in Model 5 you find a sort of holding mechanism; what do you find therein which you call a sort of holding mechanism?

Ans. The concentric portion of the groove in the cam, and the concentric portion of the cam near its periphery.

Cross-int. 52. Does not the pattern mechanism in Model A consist essentially of a combination of cam rollers?

Ans. In one sense it does. It is a pattern chain, having on its bars rollers which act as cams, or, more properly speaking, tappets, for acting upon and thus pointing out the jacks to be taken by the lifter and depresser; which lifter and depresser do not act as cams.

Cross-int. 53. In any sense, does not the pattern mechanism in Model A consist essentially of a congregation or combination of cam rollers?

Ans. It is a congregation of rollers, acting as I have before described, which may be called a cam action; but I think it is more like a tappet than a cam.

Cross-int. 54. Explain fully what you understand to be the mode of operation of what you call a sort of lifter and depresser in Model 5.

Ans. I find a cam which in its action deflects a roller, which roller has its axis upon a treddle, and such deflection moving the treddle either up or down, as the case may be. To that treddle is attached a wire leading upward, and another wire leading downward. The wire leading upward is attached to what I call lams by one end, and the other end is attached to one end of a leaf of heddles. Upon these same lams is a third arm, to which a wire is attached going across the loom part way, where it is attached to a bell-crank lever by one of its arms, while the other end of the arm is attached to the other end of the same leaf of heddles. This connection raises the leaf of heddles, and keeps it level at the same time, as the treddle descends. To the same end of the treddle is a wire extending downward, and attached to other lams by one end, while the other end is attached to the lower bar of the leaves of heddles, so that the depression of the treddle, by the action of the cam upon the roller attached to it, lifts the har-
345 ness, whilst the raising of the treddle, by means exactly analogous, depresses the harness.

Adjourned to 20th, at 9½ a. m.

Resumed: FEB. 20, 1867.

Cross-int. 55. Wherein do you consider the mode of operation of the lifter and depresser in Model 5 to be essentially different from the lifter and depresser in Model A?

Ans. In Model 5 each leaf of heddles has its own peculiar lifter and depresser, which is the cam primarily, and which only has one action upward and one action downward during eight picks of the loom, selecting its own leaf of heddles to be raised, and raising it at the same time; doing this always in the same way, and at the same position in the revolution of the cam. In Model A, the lifter and depresser are common to all the leaves of harness, be the same more or less, making a movement upward and a movement downward at every pick of the loom, taking with them only such leaves of harness as are indicated and brought within their range of motion by the pattern chain.

Cross-int. 56. In the lifter and depresser of Model A, there is a part or section which acts upon one jack and no other, is there not?

Ans. There is. That is to say, the particular part that acts upon a jack acts upon no other jack, but it does not always act upon that jack at every movement upward or downward which it makes.

Cross-int. 57. If I pick up a chair in one part of a room and carry it to and set it down in another part of the room, would such have been done by the exercise of a function of the chair?

Ans. I should think not.

Cross-int. 58. Why not?

Ans. Because I should think it would have been done by you.

Cross-int. 59. Please explain fully the mode of operation of the pattern mechanism of model Exhibit 5.

Ans. The pattern mechanism in Exhibit 5, as I understand it,
346 is embodied in the cams, which are so rotated as to move through one revolution at every eight picks of the loom. Now, considering this cam as a circle containing 360 degrees, and then considering the cam per se, which goes to operate each particular leaf of harness, the pattern is made up by the location within that circle of the several inclined planes which go to produce a movement upward and downward.

Cross-int. 60. Please explain the mode of operation of the holding mechanism in model Exhibit 5.

Ans. The holding mechanism in Exhibit 5 is the same as relates to the pattern as the mechanism last described; that is to say, the time that each particular leaf of harness shall remain at rest is determined by the number of degrees contained in the concentric surfaces of the cams. These surfaces, being concentric, do not in their movement change or admit of any change of the harness; they pass over the roller continually whenever the loom is in motion.

Cross-int. 61. Please explain what you think is the difference between the mode of operation of the holding mechanism in Model Exhibit 5, and the holding mechanism in Model A.

Ans. For the purposes of this weaving, the difference is, in one loom (Model 5), as it now stands, there can be but one movement of the treddle made during eight picks, that is to say, a movement outward and a movement inward; while in Model A there can be more than one movement made outward and inward during eight picks of the loom by simply changing the parts now on the pattern chain. That cannot be done in Model 5 by any change of the parts now upon it.

Cross-int. 62. But that could be done on Model 5 by taking off some of the sections and putting others on, could it not?

Ans. It could not be done without putting on more than are now on. You would have to double the number of inclined planes, and to double the number of holding parts.

Cross-int. 63. Are you willing to swear that that could not be done in Model 5 without having a larger number of cam sections on than are now on?

Ans. I am not; but I know that it cannot be done with what
347 are now on. You can't make it out of the material that is now on without changing its shape, nor can you with changing its shape.

Cross-int. 64. Cannot that be done in Model 5 by having the same number of cam sections on, and no more than are now on?

Ans. I believe not.

Cross-int. 65. Are you willing to swear that it cannot?

Ans. I am, if I understand your question.

Cross-int. 66. How do you understand the question?

Ans. I understand your question to be as to the sections which go to constitute the cam in its revolution. Now, here are really in this cam, for the purpose of making a movement outward, and holding the lever there, and a movement inward, and holding the lever there, two sections, one the outer section and the other the inner section. In order to make two movements to one revolution, there must be twice as many of those sections as there now are.

Cross-int. 67. Suppose the chain links at one side of the pattern chain of Model A to be permanently connected with the bars and with each other, so that the length of the pattern chain cannot be increased, but leaving the chain-links at the other side of the pattern chain removable,

so that cam rollers may be applied to or shifted on the bars, would Model A then contain substantially the same combination of jacks, lifter and depresser, pattern mechanism, and holding mechanism that it now does?

Ans. I should think not.

Cross-int. 68. Suppose a man were to construct a loom precisely like Model A, with eight bars in the pattern chain, and with the cam rollers in the same position they are now, and were to use that loom so constructed, and in that condition and in no other, in your judgment would such construction and use be employing what you understand to be the combination of mechanism for forming and shifting the shed described in the reissued Marshall patent?

Ans. I believe it would.

And in answer to direct interrogatories resumed by Causten Browne, esq., of counsel for complainant, deponent saith as follows, viz:

348 Int. 12. Will you please to read over carefully the last two interrogatories, and your answers to them, and see whether you surely understand those interrogatories, and have clearly expressed your whole meaning?

Ans. I shouldn't change the answers as I apprehend the questions. If I apprehend question No. 67, it supposes a pattern chain which would not be a pattern chain. It would not be flexible on one side, and therefore could not conform to, or be controlled by, the prism cylinder. It possibly might be made to work as a mere feat with only eight bars in it. It wouldn't be practically useful even then. If there were fifty bars in it, or more, you couldn't get it on there so as to work at all. The pattern chain on Model A is flexible at both ends of the bars, and does conform to the pattern prism, as it would if there were forty bars in it, or a hundred, or a thousand, or more; so that it comes to this, that for the purposes of this loom, the pattern chain must be flexible, or else the loom has no commercial value.

Int. 13. You stated, in your direct examination, that you think that the holding mechanism of this loom, represented by Model B, would be substantially unchanged by having the concentric portions removed, or by working with a shed so small as to leave them out of action, the friction being increased, and you also say, in your cross-examination, that you very much doubt whether the friction pieces acting on the collars in Model F (supposing that model to be without notches), would be within the combination covered by the Marshall reissue patent. How do you distinguish between the two cases?

(Objected to.)

Ans. As I understand the Marshall loom, the combination therein which enumerates jacks, lifters and depressers, pattern mechanism, and a mechanism for holding any of the jacks in their elevated and depressed positions, describes that holding mechanism as a locking mechanism—that is, a mechanism which can be locked and unlocked at each of the extremities of movement of the jacks. And to the proper working of such a mechanism it is necessary, in order to give commercial value to the loom, that these jacks, with their harness levers at their extreme

349 movements, should be so locked as not to be displaced from their locking without considerable exercise of power, so as to be able to maintain their hold, keeping the sheds in their position at considerable of an angle from their direct line of tension, so that the beat of the lathe, in closing home the woof, should not disengage the locking. Now, Model B, modified so that the locking shall be upon that portion of the cam groove in the sector which is very slightly eccentric, and with

a slight additional friction upon the sector, locks the jacks with the heddles firmly; because, by the parallelogram of forces, that portion of the power exerted by the warp upon the harness lever which goes to the rotary movement of the disk is very small. Abating friction, it would be just equal to the radial rise as compared to the circumferential movement of the inclined plane within the disk. Now, in the movement of the loom all the power necessary through the whole sweep of the change of the shed would be only equal to that proportion to which I have before referred, because it would have nothing more to do than to move the sector with the friction upon it, the power being applied to the teeth of the gear upon the sector for that purpose. Going, now, to Model F, and regarding those levers which have no notches in their collars, it will be observed that they hold at the extremes of movement, offering no greater resistance than is offered at any other point of their movement. This I regard as so objectionable as to take them out of this question, because, that in order to weave with such a loom, the friction through all the parts of the movement must be just as great as at the ends of the movement, and, therefore, that such an arrangement would be useless. But if you take the one with the notches in the collar, it will be observed that the power which it takes to lift the latch out of the notch is very much greater than the power required to move it, after it is out, from one notch to the other. Now, such a modification does lock the harness levers at their extreme limit of movement, and can be changed without any considerable expenditure of power from one side to the other, and I therefore regard that as coming within the combination.

And in answer to cross-interrogatories resumed by J. D. Ball, esq., of counsel for defendants, deponent saith as follows, viz.:

350 Cross-int. 69. You say, in your answer to the 12th direct resumed, that, if you apprehend question No. 67, it supposes a pattern chain which would not be a pattern chain. Now, suppose that the chain links at one side of the pattern chain of Model A be permanently connected with the bars and with each other, so that the length of the pattern chain cannot be increased, but leaving the chain links at the other side of the pattern chain removable, so that cam rollers may be applied to or shifted on the bars, and leaving the whole chain flexible, would Model A then contain substantially the same combination of jacks, lifter and depresser, pattern mechanism, and holding mechanism that it now does? You will please observe that the connection which I suppose is not to be a rigid connection, but a permanent one.

Ans. If you wish me to answer that question you will have to show me such a thing as you mean to refer to, or else explain your question more fully. I can't understand how the bars can be permanently connected with the links and the links with each other and still have a flexible chain.

Cross-int. 70. Now suppose that the chain links at one side of the pattern chain of Model A be permanently connected with the bars and with each other (as shown in Exhibit 12, N. A. P., Ex'r), the links having been put on the bar so as to be flexible, and a shoulder formed on the bar after the links were thus put on it, so that the length of the pattern chain cannot be increased except by severing the parts, but leaving the chain links at the other side of the pattern chain removable, as they are now in Model A, so that cam rollers may be applied to or shifted on the bars and leave the whole chain flexible; would Model A then contain substantially the same combination of jacks, lifter and depresser, pattern mechanism, and holding mechanism that it now does?

Ans. Yes. HERVEY WATERS.

FEB. 20, 1867.

(Counsel for defendants here asks the counsel for the complainant to produce the deed alleged in said bill of complaint to be dated the 5th of May, 1859, and by which deed it is alleged in said bill Moses
351 Marshall agreed to assign his interest in the Marshall patent under the extended term to the complainant.

Counsel for complainant will give an answer to that request to-morrow.

The counsel for defendants here inquires of counsel for complainant whether he puts in evidence in this cause as a part of his evidence the deed alleged in the bill of complaint on page 7 of the printed record, as dated December 19, 1863.

Counsel for complainant replies, "Yes.")

FEB. 20, 1867.

(The counsel for complainant here states in answer to the notice given upon the record yesterday by the counsel for the defendants in regard to their visiting, examining, and working the Marshall loom at Worcester that they are entirely at liberty to do what they express their desire or readiness to do, giving the complainant notice in season in order that the mill may be open and steam on.)

Deposition of George Crompton (recalled), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 20, 1867.

Int. 1. Were you present with Mr. Henry B. Renwick when he examined the so-called Marshall loom at the Arlington Mills, at Lawrence, as testified to in this case by him?

Ans. I was.

Int. 2. Did you observe the form of that edge of the jack against which the rolls on the pattern chain acted?

Ans. I did.

Int. 3. What was its form?

Ans. It appeared to me perfectly straight.

And in answer to cross-interrogatories by J. D. Ball, esq., deponent saith as follows, viz.:

352 Cross-int. 1. Who was with you at Lawrence at the time stated in your direct examination?

Ans. Mr. Henry B. Renwick, as before stated, Mr. Causten Browne, and Moses Marshall.

Cross-int. 2. State whether or not you have been in consultation with said Marshall from time to time here, during the progress of the testimony on behalf of the complainant in the case.

Ans. I may have.

Cross-int. 3. Don't you know whether you have or not?

Ans. I recollect one or two occasions when he was present here at consultations with my counsel.

Cross-int. 4. Has said Marshall any interest in this suit?

(Counsel for complainant objects to this question, and instructs the witness that he is not bound to answer it.)

Ans. I decline to answer.

Cross-int. 5. Why do you decline to answer?

(Objected to, and advice as before.)

Ans. I decline to answer that question.

Cross-int. 6. Has any person other than yourself any interest in the prosecution of this suit?

(Objection and advice as before.)

Ans. I decline to reply.

Cross-int. 7. Has Moses Marshall any interest in the reissue patent which has been put into the case by the complainant?

(Objection and advice as before.)

Ans. I decline to answer.

Cross-int. 8. Has said Marshall had any interest either in said reissued patent or the original patent since the 5th day of May, 1859?

(Objection and advice as before.)

Ans. I decline to reply.

Cross-int. 9. Where is the instrument or deed referred to in the bill of complaint in this cause as dated May 5, 1859, by which it is alleged in said bill said Marshall covenanted and agreed with you to convey the extension or extended term of said patent?

353 (Objection and advice as before.)

Ans. I decline to reply.

Cross-int. 10. In the bill of complaint in this cause you have referred to said instrument as being produced or profert thereof made. Will you produce said instrument?

(Objection and advice as before.)

Ans. I decline to reply.

Cross-int. 11. What objection have you to the production of it?

(Objection and advice as before.)

Ans. I decline to reply.

Cross-int. 12. Is there any information either in respect to the whereabouts of that instrument, or any of its contents, that you are willing to give in this case?

(Objection and advice as before.)

Ans. I decline to reply.

Cross-int. 13. Are you willing to swear positively that when the loom (the Marshall loom at Lawrence) was in operation the shoulders of the jacks, on which the lifter and depresser operated, did not move in substantially a straight line?

(Objected to because it does not appear that the witness saw such loom in operation.)

Ans. I do not remember seeing the jacks move at all.

Cross-int. 14. Do you swear that in said Marshall loom at Lawrence, when in operation, the shoulders of the jacks on which the lifter and depresser operated would not move in substantially a straight line?

(Objected to as directed to new matter not within the direct examination, and also because the witness is not produced as an expert; and he is advised that he is not bound to answer.)

Ans. I decline to answer.

Cross-int. 15. Are you positive that the form of that edge of the jack in the Marshall loom at Lawrence against which the rolls on the pattern chain acted was such that when the lifter and depresser engaged with the shoulders of the jacks that were to be moved they, the shoulders, would not move substantially in a straight line?

(Objection and advice as before.)

354 Ans. I decline to reply.

Cross-int. 16. Are you willing to state positively and without qualification that the form of that edge of the jack against which the rolls in the pattern chain acted, in the Marshall loom at Lawrence, were perfectly straight?

Ans. It appeared to me perfectly straight.

Cross-int. 17. Did you have an opportunity offered you to operate said loom at Lawrence?

(Objected to as not within the proper limit of cross-examination, and witness is advised that he is not bound to answer.)

Ans. I decline to answer.

GEO. CROMPTON.

Deposition of Edward S. Renwick (recalled by defendants), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 21, 1867.

Int. 1. State whether you have previously given a deposition in this case?

Ans. I have.

Int. 2. Suppose the pattern mechanism in a loom represented by Model A were removed, and a pattern mechanism like that of Model 5 were substituted for it in the manner represented by drawing Exhibit 11, will you then state whether or not, in your opinion, the loom with this substitution would or would not operate practically for weaving fancy goods?

(Objected to.)

Ans. In my opinion it would.

Int. 3. State how the variety of patterns of fancy goods which could be woven on the loom having such substitution would compare with the variety which can be woven on the loom represented by Model A, as it now is, having a pattern chain of eight bars, provided that in each
355 case there is the same number of heddles, and the cam rollers and cam segments are changed to the greatest extent which each of the two pattern mechanisms admits of.

(Objected to.)

Ans. You could weave identically the same variety of patterns with each of the looms referred to in the question.

Int. 4. Can you state the number of changes in the pattern which can be made on a loom such as is represented by Model 5, and having the kind of pattern mechanism shown in that model? Is the number very large, or how otherwise?

Ans. I cannot state the exact number, because I have not made a calculation of it. It is enormously large—amounting to many millions, when the pattern mechanism has eight cam sections for each heddle, as that model has.

Int. 5. Please state whether or not you were present at Worcester on the 11th and 12th days of the present month of February, when the so-called Marshall loom was exhibited by the complainant in this case; and, if yea, please state who was present on those days respectively, and whether or not you saw that loom operated there?

Ans. I was. On the 11th the persons present were Mr. Crompton, Mr. H. B. Renwick, Mr. Wyman, the woman who operated the loom, Mr. Ball, counsel for defendant, Mr. Treadwell, and myself. There was also a young man whose name I do not know, and Mr. Davis, and a man whose name I am informed is Kelly. On the 12th the same persons were present, with the exception, I believe, of the young man whose name I have stated I do not know, and, in addition, Mr. Samuel T. Thomas was present. I saw the loom operated on both of those days.

Int. 6. Will you please state whether or not, in your opinion, in the practical operation of that loom, as then constructed, the shed could be

formed and shifted without the evener? I mean as constructed at the time you so saw it at Worcester.

Ans. In my opinion it could not.

Int. 7. Please state why not.

Ans. Because the evener in that loom performed duties which, in my opinion, were necessary in the practical operation of the loom, and which would not have been performed by other members of the
356 loom if the evener had been removed. Thus the evener in that loom completed the formation of the shed by carrying the jacks to their extreme positions, and thereby carrying the warps to their extreme positions. The evener also held the jacks which were to be moved, for the purpose of shifting the shed, after they had been disconnected from their catches by the turning of the pattern mechanism, and prevented them from being passed to their mean positions by the tension of the warp threads before the lifter and depresser came into the proper positions to move the jacks, the practical effect of which holding was to keep the shed from partially closing before it should do so. The evener also held the jacks in their extreme positions when they were not so held by the catches, and when the catches could not so hold them, because the catches were not within about a quarter of an inch of the extreme positions to which the jacks were moved.

Int. 8. In the operation of that loom was there anything except the evener which prevented the jacks which were to be shifted going in advance of the lifter and depresser after the jacks became disengaged from the spring catches?

Ans. There was not.

Int. 9. In the operation of that loom when a blank space on the pattern chain succeeded a cam roller or ball opposite a jack which was down, or a cam roller or ball on the pattern chain succeeded a blank space on a jack which was up, what effect did that have on the jacks?

Ans. Those jacks were thereby moved clear of their respective catches; the jack which was down by the lateral action of the connecting mechanism between the jack and the leaf of heddles, and the jack which was up by the direct action of the cam roller, or ball, of the pattern mechanism.

Int. 10. When this occurred whether or not there was anything, and, if so, what, which held such jacks?

Ans. There was. It was the evener.

Int. 11. State whether or not anything other than the evener held them at that time.

Ans. Nothing else.

357 Int. 12. If the evener had not held them at that time, what, in your opinion, would have been the result in the operation of that loom?

Ans. In my opinion, the jacks would have been moved towards their mean positions by the tension of the warp threads before the lifter and depresser came into positions to move them, and the shed would have been partially closed prematurely.

Int. 13. In the operation of that loom, as you saw it, at the time the evener was performing the office of holding the jacks which were moved clear of the spring catches, what was the shuttle doing?

Ans. The shuttle was passing through the shed.

Int. 14. State whether or not any, and if any, what proposition was made to the complainant, Geo. Crompton, as to running that loom, or permitting it to be run, without the evener. And what was his reply thereto?

Ans. Mr. Ball, defendants' counsel, requested me to notice the propositions which he made to Mr. Crompton, and to notice Mr. Crompton's replies. On the 11th inst., Mr. Ball proposed to Mr. Crompton to have the loom run with the evener removed. Mr. Crompton at first replied in substance that the loom was constructed to operate according to the Marshall patent, with the evener in it. On the proposition being again made by Mr. Ball, Mr. Crompton declined to do so, saying in substance that if the evener were removed the loom might break or the cloth might be injured, and that he would consult his counsel. On the 12th Mr. Ball proposed to Mr. Crompton to have the evener taken out and to let the loom be turned round by hand, so that its operation, with the evener out, could be seen; and also to have it run with the evener out, further stating in substance that Mr. Thomas would pay for any damage that might occur from such trials, and the cost of restoring the loom to its condition in case of breakage. I do not recollect all that Mr. Crompton said to this proposition, but it amounted in substance to declining to do so, and he stated again that he would consult his counsel. I recollect further, that on the evening of the 11th Mr. Ball proposed to Mr.
358 Crompton that he should telegraph or write to his counsel, and the next day, upon Mr. Ball's asking Mr. Crompton whether he had done so, he said that he had not.

Int. 15. Was Mr. Henry B. Renwick present at the time those propositions were made?

Ans. He was present in the room in the mill where they were made, and where the loom was, but whether he heard them or not, I am unable to state.

Adjourned to 2½ p. m.

Resumed:

Int. 16. State whether or not you saw said loom run with the evener out.

Ans. I did not.

Int. 17. What examination did you make of that loom to test the operation of the evener?

Ans. I noticed with great care the relative positions of the evener, the jacks, the lifter and depresser, the spring catches, and the pattern mechanism, both when the loom was running and when the loom was turned round slowly by hand. I also tried the upper heddle levers by my hand to find whether they were under the strain of the warp when they were in their upper and lower positions, and when the jacks were moved clear of the catches by the operation of the pattern mechanism.

Int. 18. Was the operation of the evener in said loom the same as, or different from, the operation of the evener in the Marshall loom which you saw at the Arlington Mills, testified to by you in your previous testimony in this case?

Ans. It was the same.

Int. 19. State whether or not you have read the testimony of Mr. Horace Wyman given in this cause, and whether or not you were present and heard his testimony as it was given.

Ans. I have read the testimony, and was present when it was given.

Int. 20. State whether or not the so-called Marshall loom which
359 you so saw at Worcester, when altered in the particulars stated by said Wyman in his testimony, was or was not in substance the same as it was before in respect to the mechanism for forming and shifting the sheds, and in respect to the operation of that mechanism.

Ans. Assuming the statement which I understand to have been made by Mr. Wyman to be correct, viz., that the loom, when so altered, operated satisfactorily in practical weaving with the evener removed, the loom when altered, as stated by him in his testimony, was not, in my opinion, in substance the same as it was before in respect to the mechanism for forming and shifting the shed, and in respect to the operation of that mechanism.

Int. 21. Please give your reasons for your opinion as expressed in your last answer.

Ans. As I understand Mr. Wyman's testimony, when he removed the evener, he changed the relationship of other members of the apparatus for forming and shifting the shed so as to enable a portion of the work previously performed by the evener to be performed by other members of the mechanism; and he also dispensed with another portion of the duty performed by the evener. He thus not only dispensed with the evener, but by changing the arrangement of the other members enabled them to do work which they did not do before, thus making a change in substance in their mode of operation. The mode of operation in weaving also was changed, in the respect that a narrower shed was formed after the change than was formed before it, the effect of which was to make less tension in the warps, and to reduce materially the strain tending to carry the jacks toward their mean positions. It is true that there were still in the loom the same pieces called the pattern mechanism, the elevator and depresser, the jacks, and the spring catches, but the proportions and mode of operation of these were changed by reducing the size of some of them, and changing the relative positions of these and others. Thus, for example, one effect of the change was, as I understand the matter, to cause the spring catches to hold the jacks at a period in the operation of the loom, when previous to such change such jacks were moved clear of the catches and were hanging upon the evener.

Another effect of the change was, that the lifter and depresser
360 carried the jacks to the extreme positions which they occupied in the loom after the change, while previous to such change the evener carried the jacks to the extreme positions which they then were caused to occupy. Another effect of the change was, that the jacks, and consequently the leaves of heddles, were held during the passage of the shuttle through the shed by the spring catches; while previous to such change the jacks and heddles were held during the passage of the shuttle by the evener. Another effect of such change was, that the jacks, and consequently the heddles, were not detained while moving toward their central positions, so that they did not move materially faster than the elevator and depresser, the result of which detaining in the loom previous to the change was, that the shoulders of the jacks could not get materially in advance of the elevator and depresser; while after the change was made, as I understand the testimony of Mr. Wyman, the shoulders of the jacks got ahead of the lifter and depresser, and the lifter and depresser following caught them up; the effect of which I should think would be that when the lifter and depresser engaged with the jacks, they would do so with a blow which would increase the jar of the loom and the wear of the parts.

Int. 22. State whether or not the Marshall reissue patent describes or suggests the alterations which said Wyman testified is made in the so-called Marshall loom at Worcester, to enable it to run without the evener.

Ans It neither describes nor suggests them.

Int. 23. State whether or not the operation of the so-called Marshall

loom at Worcester has altered your views given in your previous examinations in this case as to the necessity of the evener in the practical operation of a loom constructed in conformity with the specification and drawings of said Marshall reissue patent.

Ans. It has not; but, on the contrary, has confirmed my opinion.

Int. 24. State whether or not the curve on the jacks in the so-called Marshall loom at Worcester was greater or less than that shown in the drawings annexed to said reissue patent.

Ans. It was; the curvature being nearly double in extent upon the jacks of the Marshall loom I saw at Worcester.

Int. 25. Is there any statement in the Marshall reissue patent
361 that the shoulders of the jacks should move up and down in substantially a straight line?

Ans. There is not.

Int. 26. Is there any direction in the specification of said Marshall reissue patent in regard to the extent or purpose of the curvature of the jacks?

Ans. There is not, the only language that I have been able to find on that point being the following: "The jacks are slightly curved where the roller cams (q^1) act upon them." (See p. 25 of the printed record, lines 4 and 5.)

Int. 27. (De bene.) State whether or not, previous to the year 1849, latches which took into notches and latches, or brakes, or cams, which bore upon comparatively smooth surfaces, were known mechanical substitutes for each other for the purpose of retaining moving bodies in position.

(Objected to.)

Ans. Not to my knowledge.

Int. 28. (De bene.) State whether or not catches or latches taking into notches when forced by a spring or weight, in holding sashes from falling, would or would not be mechanical substitutes for rubbing surfaces applied to the sash and bearing against the window pane.

Ans. I have seen a great many such apparatus as are described in the question. In my opinion they would not be, and are not, mechanical substitutes for each other for the purpose of holding sashes from falling. The latches taking into notches constitute a locking mechanism for securing the sash, in certain different positions determined by the position of the notches, against the force of gravity, which tends to make the sash fall, and also against other forces that might be applied. The rubbing surfaces, however, applied to the sash or window frame for the purpose of holding the sash against the force of gravity, are not locking mechanisms, but operate by friction to hold the sash against the said force in any position to which it may be raised. They have a different mechanical operation from the latches taking into notches; they accomplish a different purpose, and they are no more mechanical substitutes for the latches taking into notches than
362 are the ordinary sash weights, cords, and pulleys used to hold sashes against the force of gravity in any position in which they may be placed.

And in answer to cross-interrogatories propounded by Causten Browne, esq., deponent saith as follows, to wit:

Cross-int. 1. (De bene.) If the change supposed in the second interrogatory to you be made, and a pattern mechanism like that of Model 5 be substituted in the manner represented by drawing Exhibit 11, for the pattern mechanism in Model A, will this pattern mechanism so

substituted as shown in that drawing, move the leaves of heddles by the revolution of the cams?

Ans. No.

Cross-int. 2. (De bene.) With the pattern mechanism, so called, contained in Model 5, and shown in Drawing 11, can you have more than one rise and one depression for each entire round of the cam?

Ans. As that pattern mechanism is now set you cannot; but by changing the cam sections upon the cam you may have more than one rise and one depression for each revolution of the cam.

Cross-int. 3. (De bene.) Please describe what you mean exactly by the changes of the cam sections upon the cam.

Ans. There are now on one of the cams of Exhibit 5 eight sections or removable pieces in all, and they are set so that one rise takes place in the revolution of the cam, and that rise continues during the passage of two sections. If additional rises were wanted, as for instance a second rise, after the section next succeeding the two at which the rise now occurs, some of the sections now on the cam would have to be taken off and others would have to be put on in different positions from the ones occupied by some of those now on. When the change was completed there would be the same number of pieces on the cam that there were before the change, viz., eight.

Cross-int. 4. (De bene.) Would the others which would have to be put on be just like those which would have to be taken off?

Ans. No.

Cross-int. 5. (De bene.) In what respects would they differ?

Ans. Those taken off, under the supposition I have given, would
363 be square at each end; while some of those put on would be square at one end and inclined at the other. The sections taken off would all be sections of the curvature of the outside of the rim. Two of those put on, in the supposition that I have made, would be of the curvature of the sections nearer the centre of the cam. One of the sections I have supposed to be put on would be inclined at each end.

Cross-int. 6. (De bene.) Suppose you wished to set up the cam which is represented in Drawing No. 11, so as to hold a jack up one pick and let it down, and afterwards hold it up again for another pick; and then let it down for the rest of the circuit of the cam, would you then use any of the inside sections now shown in the cam?

Ans. Not the identical ones; but I think it is proper to state, in order to avoid misunderstanding of my answer, that the number of sections when the cam was set up again would be the same as before, viz., eight.

Cross-int. 7. (De bene.) Would they be the same or similar sections changed in position, or would they be sections of a different form, which you would so insert?

Ans. They would be similar sections, but would not be the same. They would have the same curvarture on their outer and inner sides that the inner sections now on the cam have; but instead of each of them being inclined at one end and square at the other, each of them would be inclined at both ends.

Adjourned to 22d February, at 9½ a. m.

FEB. 22*d*.

Resumed:

Cross-int. 8. (De bene.) Under the supposition that one of the cams in Exhibits 5 and 11 is so altered as to keep a heddle up one pick, down the next, and up the third, as before stated, will you not have to em-

ploy an outer section different from any now in the cam, and different from any you have heretofore described?

Ans. The supposition mentioned in the question differs from any that has been made before. In the supposition contained in cross-interrogatory 6th, the jack (and not the heddle) was to be held
364 up one pick, the effect of which would be to hold the heddle down one pick. I will, however, proceed to answer the question in its present form, if desired.

Cross-int. 9. (De bene.) Will you please answer it, assuming the word "jack" to be substituted for the word "heddle?"

Ans. I would have to employ an outer section of the same curvature on its inner and outer sides as the outer sections now on the cam, but differing from any one of those outer sections in the respect that it would be inclined at each of its ends and corresponding in this particular with the one that I have mentioned in my answer to cross-interrogatory 5. Such section would take the place of one of the sections now in the cam.

Cross-int. 10. (De bene.) Under the supposition that one of the cams in Exhibits 5 and 11 is to keep a jack up for three picks, will you not have to employ an inner section different from any now in the cam as before described by you?

Ans. One of the sections that you would have to put on, after taking off those now on the cam, would be of the same curvature on its inner and outer sides as the inner sections now on the cam, but would differ from them in the respect that it would be square at each end instead of inclined at one end and square at the other. In this respect it would correspond in form with the intermediate outer sections now on the cam, one of which would have to be taken off when the inner section I have referred to was put on.

Cross-int. 11. (De bene.) Can you make any change in the order in which lifts and depressions shall be produced upon any one of the cams now in Model 5, without taking out some of the sections of that cam and putting in others differing in form, or size, or both, from those you have removed?

Ans. A number of changes may be made in the order of lifts and depressions produced by one of the cams inquired of, by taking off some of the sections now on the cams and putting on others of the same form (that is, curved on their outer and inner sides and square at both ends) but of different size from those now on the cam. A number of other changes might be made by taking off some of the sections of the
365 cam and putting on others identical in form and size with some of those now on the cam, viz., those sections which are inclined at one end and square at the other. A number of other changes might be made by taking off some of the sections now on the cam and putting on others of the same curvature on their inner and outer sides as those now on the cam, but differing from them in the respect that they would be inclined at each end instead of inclined at one end and square at the other.

Cross-int. 12. (De bene.) Can you make any change in the order in which lifts and depressions shall be produced upon any one of the cams now in Model 5 by merely shifting the positions of the identical sections now composing such cams?

Ans. Certainly not.

Cross-int. 13. (De bene.) Can you in Model 5, or any loom of that construction, shift any cam or cam sections laterally?

Ans. You can. You can slip the cams with the sections on them off

of the arbor on which they revolve and change their lateral order to any desired extent; and in doing this each cam with all the sections upon it corresponding with one jack or heddle can be shifted as a single piece.

Cross-int. 14. (De bene.) Can you in Model 5 shift the position of any cam protuberance laterally—that is, from one cam to the next adjacent cam?

Ans. Certainly you can; removing, of course, the section from the next adjacent cam whose place the one shifted is to take.

Cross-int. 15. (De bene.) Will the cam from which such protuberance has been so shifted to the adjacent one, then perform any duty except to hold the jacks still?

Ans. Whether it will or not depends entirely upon a number of circumstances which would differ in the different cases which may be included in the supposition. Every one of the cams, when performing any duty in weaving, has eight sections upon it, constituting cam protuberances. If one or more of these be taken off for the purpose of changing the pattern, one or more must be put on in order that the cam may do its duty properly. If one or more sections be taken off without putting others on, the cam would not be in proper condition to operate.

366 Cross-int. 16. (De bene.) Will you answer the last question, assuming that the section taken out of the next adjacent cam is put in the place previously occupied by the protuberance in the first cam, and supposing also that each of the two cams in question is provided with but one protuberance, being the construction shown in Exhibits 5 and 11 and assumed in my previous question?

Ans. The assumption stated in the last part of the question, as to the construction, as I understand it, is incorrect. There are on each of the cams of Exhibit 5 eight cam sections, or protuberances, which in that model are divided into two sets, an inner set and an outer set. I can answer the question by assuming this to be the construction in place of the assumption at the end of the question, if desired.

Cross-int. 17. (De bene.) Please understand that I mean by protuberance that part of the cam which causes the jack to rise, holds it up, and permits it to be carried down, and answer the last question.

Ans. I now understand the assumption to be as follows: That the inner sections of one cam are removed from it and are applied to an adjacent cam in place of sections taken from that cam; and that the last-named sections, viz., those taken from the second cam, are applied to the first one; and I am then asked whether such first cam (viz., that from which the inner sections have been shifted), will then perform any other duty except to hold the jack still. I answer that it will perform precisely the same duty that it did before, and will not merely hold the jack still because the cam sections removed from it, being inner sections, are fitted only to take the place of the two corresponding inner sections on the adjacent cam, and the inner sections removed from that cam, would, under the assumption in the question be put in the place previously occupied on the first cam by those removed from it; and as the inner sections of the two adjacent cams, as now set in Model 5, are identical in form and size, the operation of the two cams would be precisely the same as before the transfer was made; that is to say, each heddle would be held up for six picks, then depressed, then held down for two picks and then raised again and held up for six picks as before. If, however, the cam sections of the two adjacent cams should differ in their arrangement, as for example, if the cam sections of the first cam were

367 arranged as in Exhibit 5, with two inner sections and six outer

ones, while the cam sections of the second cam were arranged with one inner section and seven outer ones, the identical cam sections taken from the second cam might be transferred to the first cam in such manner as to simply transpose the operations upon the heddles, but the cam sections removed from the first cam could not be put in the identical places occupied by the sections removed from the second cam, nor the cam sections taken from the second cam be put in the identical places occupied by the cam sections removed from the first cam.

Cross-int. 18. (De bene.) Suppose the two cam sections making a protuberance and the outer section on each side of them (being the four sections which are now marked on Exhibit 11 with the figures 1, 2, 3 and 4, respectively) are removed from that cam and placed in the adjacent cam, so as to make two acting protuberances in the latter, and that the sections taken out of the latter be put into the first cam, will the first cam then do any work?

Ans. Certainly not. It will be inoperative in weaving.

Cross-int. 19. (De bene.) In order to make in the loom represented by Model 5 the great number of changes in the pattern which you mentioned in your direct examination, will you not have to use numbers of cam sections different in form from any one of those now represented in Model 5 or in Exhibit 11?

Ans. You would have to use some cam sections differing in form from those represented in Model 5 or Exhibit 11, in the respect that they would be inclined at each end, but having the same curvature on the inner and outer sides. The number of these required to make the greatest possible variety of patterns would be insignificantly small in proportion to the number of patterns; the number of patterns being many millions and the utmost number of such cam sections required being sixty-four.

Cross-int. 20. (De bene.) Please assume now that the last question includes differences of size in the cam sections which would have to be employed, and then answer the question.

Ans. In addition to the sixty-four sections I have mentioned, there would be required a small number of square-ended inner sections, forty in all, to make the greatest possible variety of patterns. Such
368 inner sections would differ in size from the corresponding square-ended outer sections.

Cross-int. 21. (De bene.) Would you have to use one of these square-ended inner sections whenever you wanted to hold a jack up three picks?

Ans. Yes.

Cross-int. 22. (De bene.) Will you not have to use an inner section with both ends inclined (being a form of section not shown in Model 5 or Drawing 11), whenever you want to keep a jack up one pick?

Ans. You would; such a section being one of the sixty-four I have spoken of in my answer to cross-interrogatory 19.

Cross-int. 23. (De bene.) Did I ask you whether it had been spoken of before or not?

Ans. Not that I know of.

Cross-int. 24. (De bene.) Would you not have to use an outer cam section inclined at both ends whenever you wanted to keep a jack down one pick only (being a differently shaped section from any shown in Model 5 or Exhibit 11), and please to answer this question simply "yes" or "no," if you have no objection to doing so.

Ans. Yes; but I think in order to prevent a misunderstanding of my testimony I ought to add that such a section would be one of the sixty-four I have spoken of in my answer to cross-interrogatory 19.

Cross-int. 25. (De bene.) Are not the differences of form, which you have spoken of, in the cam sections of Model 5 differences which make the cam sections perform different duties from those which are now in Model 5?

Ans. No; however you might change the cam sections on the cams, the duties performed would be identical. In every case of change the same operations would be performed, but the time during which certain operations were continued, or the times at which certain operations were performed, in the operation of weaving, or both of these, would be varied within the principle of the pattern mechanism for the purpose of varying the figure woven.

Cross-int. 26. (De bene.) Does not an inner cam section with
369 two inclined ends perform a different duty from one with one inclined and one radial end?

Ans. The former performs an additional duty to the two performed by the latter; that is, it permits the jack corresponding with it to be moved downwards.

Cross-int. 27. (De bene.) Does not an inner cam section with two radial ends perform a different duty from one having one inclined and one radial end?

Ans. No; because the former holds, and one of the duties performed by the latter is to hold in the same manner.

Cross-int. 28. (De bene.) What other duty does the latter perform besides holding?

Ans. One other duty, which may be either to raise a jack or to permit its descent, according to the position of the inclined end in the series of cam sections.

Cross-int. 29. (De bene.) Does not an outer cam section with two radial ends perform a different duty from one having one radial end and one inclined end?

Ans. No; because the former holds, and one of the duties performed by the latter is to hold in the same manner.

Cross-int. 30. (De bene.) What other duty besides so holding is performed by the latter?

Ans. One other duty, which may be either to depress a jack or to permit it to rise, according to the position of the inclined end in the series of cam sections.

Cross-int. 31. (De bene.) Does not an inner cam section with two inclined ends perform different duties from one with two radial ends?

Ans. The former performs two duties in addition to that performed by the latter.

Cross-int. 32. (De bene.) What two?

Ans. It causes the jack to rise and permits its descent in addition to holding it.

Cross-int. 33. (De bene.) Does not an outer cam section with two inclined ends perform different duties from one having two radial
370 ends; and different duties from one having one inclined end and one radial end?

Ans. The first performs two duties in addition to the one performed by the second, and one duty in addition to the two performed by the third.

Cross-int. 34. (De bene.) If one of two cam sections performs two duties or three duties, and another cam section performs only one of those duties, do you think it right to say that the duties performed by those two cam sections are identical?

Ans. Certainly not.

Cross-int. 35. (De bene.) Would it not be right to say that the duties performed by the two cam sections were different?

Ans. It would be right to say that the second cam section mentioned in the former question performed one additional duty to those performed by the first cam section mentioned in that question, which duty was different from either of those performed by the first cam.

Cross-int. 36. (De bene.) In your answer to the 25th cross-interrogatory you say, "However you might change the cam sections on the cams, the duties performed would be identical; in every case of change the same operations would be performed." Now, suppose you change from a cam section which is constructed to lift, hold, and permit to be depressed a jack, to a cam section which is constructed only to hold the jack, or only to hold and permit it to be depressed, should you say that in that "case of change the same operations would be performed?"

Ans. Certainly not at that time in the movement of the pattern mechanism.

Cross-int. 37. In making all the changes that the pattern mechanism described in the Marshall reissue and exemplified by Model A is susceptible of, so as to weave different patterns and as has been heretofore testified to, will you have to use any parts differing in form or function, or both, from those now existing in that model and described in that patent?

Ans. You would not have to use any parts differing in form from those now existing in that model and described in that patent, but you would have to use parts which differed in function from any
371 existing in that model; thus in the pattern chain of Model A there are eight removable pieces placed upon the pattern chain for each of the jacks; a portion of these are comparatively large in diameter and have been called in this case cam rollers. The remainder are comparatively small and may be called thimbles. Now, the functions performed by the cam rollers upon that model differ according to their relative positions as compared with each other and with the thimbles. When two cam rollers succeed each other as represented in Model A, the one that travels foremost in the revolution of the pattern chain performs the functions of causing a jack to be depressed and of holding it while it is being depressed, while the succeeding roller performs the functions of holding a jack while it is in a depressed position and of causing it to be raised. Now, if the pattern woven had to be changed in such a way as to require one jack to be held down for three consecutive picks, one of the thimbles would have to be removed from the pattern chain and an additional roller would have to be applied, so that there would be three rollers consecutively. In this case the first and third rollers of the three would perform the same functions as before, but the intermediate roller would have to perform only the one function of holding. Again, if the pattern were to be changed so that one of the jacks had to be depressed for only a single pick and then raised, one of the rollers now on Model A, opposite that jack, would have to be removed and a thimble put in its place. In that case such roller would stand alone with thimbles at each side of it on the pattern chain, and this single roller would perform the three functions of causing the jack to be depressed, of holding it, and of permitting it to be raised; which three functions are not all performed by any one roller now on Model A.

In the patent, the pattern chain described is referred to as "known," as it undoubtedly was at the date of the patent, and such changes as I have mentioned are within the principle of that known pattern chain. I also observe in the patent that in Figure 2 some of the rollers are shown

as preceded and succeeded by thimbles, in which case the roller would perform the three functions I have before referred to. But I do not perceive in the drawings any place where three rollers are repre-
372 sented succeeding each other, so that a roller performing the function of holding, without performing the two functions of causing the descent of the jack or permitting it to be raised is not shown in the drawings.

In making changes in the pattern with a loom constructed like Model A, or described in the patent, no function would be performed that is not now performed by some one or some other roller on the pattern chain of the model or drawing, but the same functions would not be performed by the rollers considered individually; the times of the performance of the functions and the continuance of the holding being varied according to the arrangement or the number or both of the rollers and thimbles corresponding with any particular jack.

Adjourned till 2¾ p. m.

Resumed:

Cross-int. 38. Are there not in the pattern mechanism described in the Marshall reissue and exemplified by Model A rollers so constructed and thimbles so constructed as to suffice to perform all the duties which rollers and thimbles are designed to perform and can perform under any variety of pattern in the loom represented by that model and described in that patent?

Ans. Certainly there are, but there are not enough of them.

Cross-int. 39. (De bene.) Are there in Model 5 cam sections so constructed as to suffice to perform all the duties which cam sections must perform in order to weave the varieties of pattern mentioned by you in your direct examination?

Ans. Certainly not.

Cross-int. 40. Are there not in the pattern mechanism shown in Model B, and described in the Thomas patent for that pattern mechanism, holes and covers so constructed as to suffice to perform all the duties which holes and covers are designed to perform and can perform, under any variety of pattern, in the loom represented by that model and described in that patent?

Ans. There are, and enough of each to make all the changes that can be made.

373 Cross-int. 41. If one of the covers in the loom mentioned in the last question was knocked off of the pattern chain intentionally or by accident, should you think the last question would require a different answer?

Ans. I should.

Cross-int. 42. In making all the changes that the pattern mechanism described in the patent and exemplified in the model of Thomas (mentioned in cross-interrogatory 40) is susceptible of, will you have to use any parts differing in form or function, or both, from those now existing in that model and described in that patent?

Ans. No.

Cross-int. 43. Does the fact that a certain kind of loom makes a smaller shed than is made in another loom show to your mind that the two looms have substantially different mechanism for forming and shifting the shed?

Ans. That isolated fact would not do so, but if a loom had produced a shed of one width and subsequently produced a shed of a different width, that fact would be presumptive evidence to my mind that a change had been made in the loom.

Cross-int. 44. I asked you in my last question whether a certain fact would show to your mind a certain thing; not whether that and certain other facts would show to your mind a certain other thing, and I will now thank you to listen to the last question and answer it, and not another.

Ans. I believe that I did answer it, with an explanation which I deemed necessary to prevent a misunderstanding. I will proceed to answer it again without an explanation, quoting from the preceding answer the following words, viz: "That isolated fact would not do so."

Cross-int. 45. In reply to my question whether the fact that two looms made sheds of different widths showed to your mind that they had substantially different mechanisms for forming and shifting the shed, you answered, "That isolated fact would not." Do you think that that answer leaves it doubtful whether you meant to answer my question in the affirmative or negative?

Ans. I think that it does not leave doubtful what I meant to
374 say; and what I did mean was this, that if a person should say to me that two looms produced sheds of different width, without making any other statement to me as to the construction of the looms, that statement alone would not show to my mind that the two looms had necessarily two substantially different mechanisms for forming and shifting the shed.

Cross-int. 46. Then the misunderstanding which you deemed the remainder of your answer to the 43d cross-interrogatory necessary to prevent was not a misunderstanding of the previous part of that answer, was it?

Ans. Yes, it was; for this reason: The language "two looms" would comprehend, as I understand it, either two looms placed side by side, or one loom so altered as to be in substance a different loom. In which case the loom as it first stood would constitute one loom, and the loom when altered would constitute a second loom to be compared with the first.

Cross-int. 47. In your answer to the 45th cross-interrogatory, you say that you think the answer, "That isolated fact would not," does not leave doubtful what you meant to say in answer to the question belonging to that answer. Do you now mean to say that you think such answer would not be understood, without your adding to it what you did add?

Ans. Those words alone were given in reply to the 44th cross-interrogatory, and after I had made my explanation in the 43d cross-interrogatory preceding. I think that my answer, as quoted, to the 44th cross-interrogatory could not be misunderstood after the explanation I had given in my answer to cross-interrogatory 43d.

Cross-int 48. Do you think that the words, "That isolated fact would not," considered as an answer to the 43d cross-interrogatory, leave it doubtful whether you meant to answer that question in the affirmative or negative?

Ans. I think that it leaves it doubtful what I intended to be understood under the two states of facts which occurred to my mind at the time as being comprehended by the question as stated in my answer to cross-interrogatory 46th. I think, further, that if I had not made
375 the explanation that I did, the answer would have amounted to a merely negative answer, which without explanation would not have expressed what I meant to say.

Cross-int. 49. Does the fact that a certain kind of loom makes a smaller shed than is made in another loom show, to your mind, that the two

looms have substantially different mechanism for forming and shifting the shed?

Ans. It might, or might not, according to circumstances.

Cross-int. 50. Would the fact I mention, without other facts which I do not mention, show or not show that the two looms have a substantially different mechanism for forming and shifting the shed?

Ans. It would not, without other facts, be sufficient evidence that the two looms have substantially different mechanisms for forming and shifting the shed.

Cross-int. 51. In the loom as adjusted by Mr. Wyman (referring now to your direct examination) to run without the evener, and running without the evener, will not the shed still be opened by jacks acted upon by lifters and depressers?

Ans. In the loom as altered by Mr. Wyman, the shed would be opened by the operation, among other things, of lifters and depressers upon jacks; but I do not think it would be proper to say that the shed would still be opened by the operation of lifters and depressers upon jacks, because such language, to my mind, requires a comparison of the loom in its altered state with the loom before such alteration when the evener performed part of the work of opening the shed.

Cross-int. 52. In the loom, as so adjusted and running without the evener, do not the jacks still have motion in two directions, one derived from lifters and depressers, and the other from the pattern chain and spring connection?

Ans. In the loom as altered and running without the evener, the jacks have motion in four directions, two up and down, and two in and out; and all these motions are derived from the lifters and depressers, the pattern chain, and the spring connections, without other instrumentality except the tension of the warps. In the loom, before its alteration, portions of the motions up and down were derived from the evener, and other portions from the lifter and depresser, in addi-
376 tion to the action of the strain of the warp, the motions in and out being derived from the operation of the pattern mechanism and the spring connections with the heddles.

Cross-int. 53. In the loom adjusted as above mentioned, are not the jacks carried up and down by the lifter and depresser, and in and out by the pattern chain and spring connections, as they were before such adjustment?

Ans. In the loom so altered, the jacks are carried up and down, partly by the lifter and depresser, and partly by the tension of the warp without control, but not as they were before; because before the alteration they were carried up and down in part by the lifter and depresser, in part by the evener, and partly carried to their central positions under the control of the evener by the tension of the warps. The jacks are carried in and out by the pattern-chain and spring connections, as they were before such alterations.

Cross-int. 54. Do not the lifters and depressers do the same work of lifting and depressing the jacks, which they did before the adjustments mentioned?

Ans. I believe they do.

Cross-int. 55. Do not the warp threads do the same work in moving the jacks, which they did before the Wyman adjustments, differing only in the extent of motion?

Ans. The warp threads in the loom after the alteration do the same work in moving the jacks, but differ in the extent to which they move them, and also in the respect that before the alteration the movement

by the tension of the warps was under the control of the evener, while after the alteration it was not.

Cross-int. 56. Do the lifters and depressers lift and depress the jacks to the same extent that they did before the Wyman adjustments, or, if you prefer the word, "alterations?"

Ans. I believe they do, but am not certain; because I have an impression that before the alteration the evener came in and took the jacks from the lifter and depresser a little before the lifter and depresser had carried them as far as they might otherwise have carried them; how soon before, I am unable to say; and whether the cutting off of
377 the lifter and depresser, as testified to by Mr. Wyman, would or would not reduce the distance to which the lifter and depresser carried the jacks before the evener took them, as the loom stood when I saw it, I am unable to determine without having an exact drawing of the loom before the alterations, so that I might lay down upon it the alterations.

Cross-int. 57. In the loom so adjusted, or, if you prefer, "altered" by Mr. Wyman, do not the pattern chain and spring connections still select the jacks to be moved?

Ans. They do.

Cross-int. 58. In the loom as so adjusted, or, if you prefer, "altered," do not the latches still hold jacks, and consequently heddles, both in elevated and depressed positions?

Ans. They do; but they hold them at a period in the operation of the loom when they did not so hold them before the alteration, viz., when the shuttle is passing through the shed.

Cross-int. 59. Do they not also hold them at the same period when they did hold them before?

Ans. Certainly they do.

Cross-int. 60. In the loom as so adjusted, or, if you please "altered," do not the latches still hold some jacks up while others are being moved down, and some jacks down while others are being moved up?

Ans. They do; but I think it is proper to add, to prevent misunderstanding, that, after the alteration, the latches also hold some jacks up and some down at a period in the operation of the loom when they did not hold them before the alteration.

Cross-int. 61. Do the latches in the loom as so adjusted, or, if you prefer "altered," do any less work than they did before?

Ans. No; on the contrary they do more.

Cross-int. 62. Do you consider the proposition that *a* does more than *b* to be the contrary of the proposition that it does not do any less? Is it not an additional statement which in this instance was not called for by the last question?

Ans. I suppose if the language, "on the contrary," be used in its strictest acceptation, the use of that language would not be strictly correct; but in the ordinary acceptation, in which I have often heard
378 them used, I think that they are not used incorrectly. The portion of the answer to the preceding question after the word "no," was additional to the word "no," and may perhaps not have been called for by a strict construction of the language of the question.

Cross-int. 63. Is the loom since the adjustments, or, if you prefer "alterations," still an open-shed loom?

Ans. It is.

Cross-int. 64. Do the spring latches make it so?

Ans. Not of themselves alone; they help to make it so.

Cross-int. 65. Would it be an open-shed loom without them and their actions upon the jacks and heddles?

Ans. No.

Adjourned to 23d inst., at 9½ a. m.

Resumed:

Cross-int. 66. What do you understand by a mechanical substitute as distinguished from a mechanical equivalent?

Ans. By a mechanical substitute I understand an instrumentality which when put in the place of another instrumentality will do precisely the same work as the instrumentality it replaces, without necessarily having the same mode of operation—as, for example, when a lever is used in place of a screw for the purpose of raising a weight, or in a steam engine a parallel motion is substituted for guides for the purpose of causing the cross-head of the piston to move to and fro in a straight line. A mechanical equivalent, as I understand it, is an instrumentality which when put in the place of another will do the same work as the one it replaces, and have the same mode of operation; as, for example, when a screw is put in the place of a wedge, both having the principle of an inclined plane; or a pulley is put in the place of a wheel and axle, both involving the principle of the lever.

And in answer to direct interrogatories resumed by J. D. Ball, esq., the deponent saith as follows, viz:

Int. 29. State whether or not pattern mechanisms of the kinds represented in Exhibit 5 and Model A are or are not both pattern
379 devices composed of removable sections suitable for moving jacks in a fancy loom such as is represented by Model A, and capable of variation by changing their removable sections, so as to vary the pattern woven?

(Objected to for form and substance.)

Ans. They are.

Int. 30. State how many or about how many changes can be made in the pattern model 5, without the addition of a single cam section besides those now in said model, and without the alteration of the form of any of them, and how these changes in the pattern can be made?

(Objected to.)

Ans. In rough numbers, several millions. In that pattern mechanism the removable sections upon each cam disk can be set in different positions upon the cam disk to which they are secured. The effect of each one of such changes would be to cause the warps controlled by the heddle corresponding with such cam to appear in a different place in the pattern. By progressively changing the cam sections of one cam without changing those of the others, eight changes can thus be produced in the pattern woven. By changing the section of the second cam in like manner without changing those of the first, eight more changes can be produced, and as each of these changes of the second cam can be combined in succession with the eight changes that may be produced by the first cam, the progressive changing of the cam sections upon the two cams simultaneously will produce eight times eight, or sixty-four changes. By applying the same calculation to the third cam in succession, it will be found that eight times sixty-four, or five hundred and twelve, changes may be produced; the changing of the cam sections of each cam in succession rendering it possible to produce eight times as many changes as those produced by combining together the

changes of the preceding section. Extending the calculation to the eight cams it will be found that upwards of twelve millions of changes can be produced.

Int. 31. Take the pattern chain now on Model A, with its eight bars, and suppose you had been weaving a pattern which required one jack to be held up for seven picks and down for one pick, if you then wished to change the pattern so that the same jack should be held down
380 for the seven picks it had been previously held up, and held up for one pick, what changes would you have to make in that pattern chain?

Ans. In the first instance, there would have been seven thimbles and one roller upon the pattern chain opposite the jack to be held up seven picks and depressed once. In making the change, those eight removable pieces or sections would all have to be taken off, and in place of them seven rollers and one thimble would have to be put on; the one thimble in the place of the previous roller and the seven rollers in the places of the seven previous thimbles.

Int. 32. In making the change supposed in the last question, would you require any more cam rollers than those previously used on the chain?

Ans. You would require six more for the jacks whose motions were to be changed.

Int. 33. Suppose you had been weaving a pattern on Model A with its pattern chain and eight bars, which pattern required one jack to be held up for six picks and down for two, if you then wished to change the pattern so that the same jacks should be held down for the six picks which had been previously held up, and held up for two picks, what changes would you have to make in that pattern chain?

Ans. In the first instance, there would have been six thimbles and two rollers upon the portions of the eight bars of the pattern chain opposite the jacks. In order to make the change, those eight removable pieces would all have to be taken off, and six rollers and two thimbles would have to be put on in their places; the six rollers in the places previously occupied by the six thimbles, and the two thimbles in the places previously occupied by the two rollers.

Int. 34. In making the change supposed in the last question, would you require any more cam rollers than those previously used on the chain?

Ans. You would require four more rollers than now on the chain.

Int. 35. Suppose you were to make the like change in loom model 5 to that suggested in the 33d direct interrogatory, what would you have to do?

Ans. In the first instance there would have been upon the cam opposite the jack, six inner sections and two outer sections. In
381 order to make the change, these removable pieces would all have to be taken off, and in their places two inner sections and six outer sections would have to be put on, the two inner sections upon the parts of the cam disk corresponding with the places from which the two outer sections had been removed, and the six outer sections upon the portions of the cam disk corresponding with the places whence the six inner sections had been removed.

Int. 36. In making the change supposed in the last question, would you require any more sections than those used in the pattern immediately before?

Ans. You would require four outer sections which had not been used before. Those four outer sections would be of the same shape as the

four inner sections laid aside, namely, square at each end, but larger in size than such inner sections.

Int. 37. In making changes in the pattern in loom Model B, what is necessary to be done in the pattern chain?

Ans To turn some of the covers over the holes in the plates, or to turn others away from the holes in the plates, or to do both these things, without adding pieces to or taking pieces from the chain of plates.

Int. 38. Suppose in the pattern chain as it now is in Model A, you take the four cam rollers which are opposite one jack and remove them so as to place them opposite the adjacent jack, what would be the effect as to the operation of the loom?

Ans. Both of the two jacks will be held out of operation and would have no effect in the formation of the pattern; that one of them from opposite which the rollers were removed being held up the whole time, and that one opposite which the rollers were applied being held down the whole time. If warps were passed through the heddles controlled by these jacks, the warps controlled by the jacks held up would be extended along the under surface of the cloth without being interwoven in it, and the warps controlled by the jack held down would be extended along the upper surface of the cloth without being interwoven in it.

Int. 39. Suppose in the pattern chain as it now is on Model A,
382 you remove the cam rollers which are opposite the two inner jacks and place them opposite the two outer jacks, what effect would it have upon the operation?

Ans. All the jacks would be held stationary and be inoperative, and no weaving will take place.

E. S. RENWICK.

Deposition of Francis E. Treadwell (recalled by defendants), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 23, 1867.

Int. 1. State whether or not you have been previously examined as a witness in this cause.

Ans. I have.

Int. 2. Suppose the pattern mechanism in a loom represented by Model A were removed, and a pattern mechanism like that of the Middlesex Mills loom represented by Model 5, was substituted for it in the manner represented by drawing Exhibit 11, will you then state whether or not, in your opinion, the loom with this substitution would or would not operate practically for weaving fancy goods?

(Objected to.)

Ans. In my opinion it would operate practically for weaving fancy goods.

Int. 3. State how the variety of patterns of fancy goods which could be woven on loom A, having such substitution, would compare with the variety which could be woven on loom A, as it now is, having a pattern mechanism of eight bars, provided that in each case there are the same number of heddles, and the cam rollers and cam segments are changed to the greatest extent which each of the pattern mechanisms is capable of being changed.

Ans. The variety would be the same in each case.

Int. 4. Can you state whether or not the number of changes in the pattern which can be made on the Middlesex Mills loom represented by Model 5 is very large or very small or otherwise?

Ans. It is very large, amounting to millions of changes, assuming

that the changes are made within the principle which governs the
383 changes in that pattern mechanism, under which assumption I answered the last question as to both pattern mechanisms referred to therein.

Int. 5. State whether or not you were present at Worcester on the 11th and 12th days of February current, when the so-called Marshall loom was exhibited by Mr. Geo. Crompton, the complainant; and, if yea, whether or not you saw that loom operated there, and who was present on those days at its operation?

Ans. I was present at Worcester on the days mentioned in the question, and saw the loom referred to operated. On the 11th inst., there were present, Geo. Crompton, the complainant, Henry B. Renwick, Horace Wyman, a woman, who operated the loom, whose name I do not know, Joshua D. Ball, of counsel for defendant, Edward S. Renwick, Mr. Davis, a weaver, who I am informed was named Kelly, and myself. On the 12th the same persons were present, and also Samuel T. Thomas. The loom was operated on both occasions by the woman I have mentioned, assisted by Mr. Wyman.

Int. 6. Will you please state whether or not, in your opinion, in the practical operation of that loom as then constructed, the shed could be formed and shifted without the evener?

Ans. In my opinion it could not.

Int. 7. Will you please state why not?

Ans. Because in that loom the evener was the mechanical device that held the jack, and consequently the leaves of heddles and their warp threads, in their extreme elevated and depressed positions, and there was no other mechanical device in the loom which did or could hold them in such positions. Also, because the evener held the jacks in the elevated and depressed positions, when thrown off or permitted to be drawn out of range of the spring latches for the purpose of being moved up or down in shifting the shed, and there was no other mechanical device in said loom that could hold them in that position at that time; the evener also controlled the movements of the jacks, and consequently their heddles and warp threads, towards their mean positions, and thereby preventing the jacks, heddles, and warp threads going to their mean positions in advance of the movements of the lifter and depresser.
384 In that loom, in my opinion, if the evener were taken out, the operation of weaving would not be practicable, for the reason that the other mechanism did not control the warp threads sufficiently to weave the pattern indicated by the pattern mechanism.

Int. 8. What was the practical effect in that loom of the evener holding the jacks that were to be shifted, and controlling their movement after such jacks were moved out of range of the spring latches?

Ans. The effect was to prevent the warp threads controlled by those jacks from going into the middle of the shed or towards the middle of the shed prematurely, thereby preventing the confusion of the woven pattern, or trapping the shuttle, which would be the practical effect of the removal of the evener in that loom.

Int. 9. In the operation of that loom, was there anything, other than the evener, which prevented the warp threads, controlled by said jacks, from going into the middle of the shed or toward the middle of the shed prematurely, in advance of the lifter and depresser?

Ans. There was not.

Int. 10. In the operation of that loom, when a blank space in the pattern chain succeeded a cam roller or ball opposite a jack which was down, or a cam roller or ball on the pattern chain succeeded a blank

space on a jack which was up, what effect did that produce on those jacks?

Ans. They were moved laterally from the positions they had occupied to positions out of range of the spring latches, so that the spring latches would not obstruct their motion when the evener allowed them to be elevated or depressed.

Int. 11. When the jacks were thus moved out of range of the spring latches, was there anything, and if so, what, which held them?

Ans. There was. The evener held them, as well as all the other jacks, at that time; the shoulders of all the jacks, whether moved laterally or not, being beyond the spring latches.

Int. 12. State whether or not at that time anything other than the evener held them.

Ans. Nothing but the evener. The jacks that were up had their holding shoulders above the upper series of spring latches, and the jacks that were down had their shoulders below the lower series of spring latches.

385 Int. 13. If the evener had not so held the jacks that were to be shifted at the time they were out of range of the spring latches, what would have been the result in the operation of that loom?

Ans. In my opinion, the result would have been that the tension of the warps would have caused the jacks that were to be shifted to move to or towards the middle of their movement, with the results upon the shed I have before mentioned. Besides this result, I think there would have been another result, namely, the movement of all the rest of the jacks until arrested by the spring latches, for the reason that if the evener did not hold the jacks that were to be shifted at that time, it could not, as the loom was constructed, hold the rest; the effect of this movement of all the rest of the jacks to the spring latches would be to make the shed narrower, and so cripple the loom in its operations in weaving. I noticed that the shed was quite narrow, hugging the shuttle even with the evener in operation.

Adjourned to 3 p. m.

Resumed:

Int. 14. In the operation of that loom, as you saw it at the time the evener was holding the jacks, which were moved clear of the spring catches, what was the shuttle doing?

Ans. At that time the shuttle was going through the shed.

Int. 15. Please state whether or not any, and, if any, what proposition was made to the complainant Geo. Crompton, as to running that loom, or permitting it to be run without the evener, and what was his reply thereto, if any?

Ans. On the first day I saw that loom (the 11th inst.), Mr. Ball requested Mr. Crompton to have the evener removed from the loom, and the loom run without it. Mr. Crompton, in reply, stated in substance that the loom was built in accordance with the Marshall patent to run with the evener, and declined to have the loom operated without it, and said he would consult with his counsel; whereupon Mr. Ball requested him to telegraph to his counsel, and stated that he should return with us the next morning to see the loom again. The

386 next morning (the morning of the 12th inst.), Mr. Ball renewed his request to have the loom operated without the evener, and Mr. Crompton, in substance, replied that the loom was not made to run without the evener, and, if so run, might break or damage the fabric in the loom, and declined to have it so run, saying that he would consult

with his counsel respecting the request. He also said, at that time in substance, in reply to an inquiry of Mr. Ball, that he had not telegraphed or communicated with his counsel since the preceding day. Mr. Ball also requested that the evener should be removed, and the loom run without it, on condition that Mr. Thomas should pay for all damage that occurred in consequence, which proposition Mr. Crompton also declined. Mr. Ball further requested that the evener should be removed, and the loom operated without it, turning the loom by hand slowly. This request was also declined by Mr. Crompton. I believe this to be the substance of what occurred, but I cannot state the conversation precisely.

Int. 16. State whether or not you saw said loom run without the evener.

Ans. I did not. It was not run without the evener, while I was there.

Int. 17. What examination did you make of that loom to test the operation of the evener?

Ans. I made a very careful examination of the construction, relative position, and movements of the mechanism for forming and shifting the shed, viz., the pattern mechanism, jacks, lifters, and depressers, spring latches, and the evener; observing the operation of these parts while in motion in the operation of weaving, and also when the loom was turned slowly by hand, I placed my fingers upon the lance-shaped ends of the heddle levers, which operated in conjunction with the bars of the evener, and endeavored in various ways to test the pressure upon the bars of the evener of the lance-shaped ends of the upper heddle levers, caused by the tension of the warps acting upon the heddle levers through the heddles, and ascertained that there was considerable strain and pressure upon the evener, enough, in my opinion, to have caused instantaneous and rapid motion of the heddle levers, jacks, and warps controlled by them,
387 if they were not restrained by the presence and operation of the evener. I also noticed particularly that the evener held the jacks, both those to be shifted and those not to be shifted, at the time of selecting the jacks above the upper series of spring latches, and below the lower series of spring latches. That is, the holding shoulders of the jacks that were down, did not rest upon the lower series of spring latches, but were held below them, and the holding shoulders of the jacks that were up did not rest upon the upper series of spring latches, but were held above them.

Int. 18. State whether or not the operation of the evener in said loom was the same as, or different from, the operation of the evener in the Marshall loom which you saw, as testified to by you before, at the Arlington Mills.

Ans. It was the same.

Int. 19. State whether or not you have read the testimony of Mr. Horace Wyman, given in this case, and also whether or not you were present and heard his testimony, as he was giving it.

Ans. I was present and heard his testimony, and have read it.

Int. 20. State whether or not the so called Marshall loom, which you so saw at Worcester, when altered in the particulars stated by said Wyman in his testimony, was or was not, in substance, the same as it was before in respect to the mechanism for forming and shifting the shed, and in respect to the operation of that mechanism.

Ans. In my opinion, it was substantially different in substance, both in construction, mode of operation, and effect.

Int. 21. Please give your reasons for your opinion expressed in your next preceding answer.

Ans. My reasons are as follows: In the first place, the loom, as altered by Mr. Wyman was deprived of the evener, which for reasons I have before stated was one of the essential elements of the holding mechanism of the loom, as it stood before, and also was the only means of controlling the premature movement of the jacks to be moved, and consequently the heddles and their warps, in the loom as it stood before the alteration. The other alterations testified to by Mr. Wyman were of a nature to remedy, as far as possible, the defects of the loom, which required the use of the evener. First: The scope of action of the
388 parts which operated to open and hold open the shed was diminished. I mean the heddles in the loom, as altered, were not moved as far, and held as far up and down, from their mean positions, thus making a narrower shed, and, as a consequence thereof, the strain of the tension of the warp threads was not as great, and did not therefore act with so great force and quickness to move the jacks, and consequently the heddles and the warp threads to be shifted, as before, and therefore the lifter and depresser was more likely to keep up with the movement of the jacks towards their mean positions. In the second place, the spring latches were changed in their positions for the purpose of receiving and delivering of the jacks upon them, when carried up or down by the lifter and depresser; whereas in the loom before it was altered, the jacks were transferred from the lifter and depresser to the evener, when moved up or down by the lifter and depresser, and did not bear upon the latches until the evener in the operation of the loom moved away from the heddle levers. The third alteration was to cut off a portion of the lifters and depressers, the portion cut off being one sixteenth of an inch off the outer sides of both lifter and depresser. The consequence of this alteration was to diminish the range of motion of the jacks, or, in other words, to diminish the extent to which they might have been carried up or down by the lifters and depressers as they stood before, and to such extent diminished the strain of the tension of the warps and their effect upon the action of the loom from what it would have been had the lifter and depresser not been altered when the evener was taken out. Another effect might have been produced, or rather permitted by this cutting away of the lifter and depresser, viz., the addition of one-sixteenth of an inch on each side of the lateral movement of the jacks. I cannot speak of this with certainty, because I do not know whether the prongs of the jacks were sufficiently near together to make it necessary to cut away either the inside edges of the prongs, or to cut away the outside edges of the lifter and depresser, to get freedom for a greater extent of lateral motion, but if it were, this would be the way to do it. The other alterations of moving the position of the pattern mechanism, the position of the upper heddle levers and setting out the inner series of spring latches, stated by Mr. Wyman, appear
389 to me to have been made for bearing upon the spring catches, so that they would not be thrown off at the same extent of the lateral movement caused by the pattern chain as before. Now, the loom with these alterations, if they have enabled it to work practically without the evener, must have these parts in a substantially different relation to each other than they were before, when they would not and could not operate practically without the evener; and therefore there being no change in the number of parts left, I consider that the combination of such parts must be substantially different. I do not wish to be understood as giving an opinion that the loom as altered by Mr. Wyman does or will work practically for fancy weaving. I think it will work under great difficulties, if at all, because the difficulty which the evener was

placed in the old loom to remedy still must exist in the loom as altered to some extent; there being no mechanism in that loom to control the movements of the jacks and warps towards their central positions. My opinion, as above given, is based partly upon the statement of changes made by Mr. Wyman, and partly upon his statement that the loom works satisfactorily.

Adjourned to 9½ o'clock, 25th inst.

FEB. 25, 1867.

Resumed:

Int. 22. State whether or not the Marshall reissue patent describes or suggests the alterations which said Wyman testified he made in the so-called Marshall loom at Worcester to enable it to be run without the evener.

Ans. It does not.

Int. 23. State whether or not the operation which you saw of the so-called Marshall loom at Worcester has altered your views, given in your previous examination in this case, as to the necessity of the evener in the practical operation of a loom constructed in conformity with the specification and drawings of the said Marshall reissue patent.

(Objected to.)

Ans. It has not altered my views, but, on the contrary, has confirmed them.

390 Int. 24. State whether or not the curvature of the jacks in the so-called Marshall loom at Worcester, as you saw it, is greater or less than that shown in the drawings annexed to said reissue patent.

Ans. It was nearly double that shown in the drawings.

Int. 25. State whether or not there is any direction in the specification of said Marshall reissue patent in regard either to the extent or the purpose of the curvature of the jacks.

Ans. There is not. The statement in the patent is that "the jacks are slightly curved where the roller cams (q^1) act upon them."

Int. 26. Is there or not any statement in the Marshall reissue patent that the shoulders on the jacks should move up and down in substantially a straight line?

Ans. There is not.

Int. 27. (De bene.) Previous to the year 1849 were latches which took into notches and latches, or brakes, or cams which bore upon comparatively smooth surfaces known mechanical substitutes for each other for the purpose of retaining moving bodies in position?

Ans. Not that I know of. They are not now, and I do not see how they ever could have been.

Int. 28. Please state whether or not prior to 1849, or since, rubbing surfaces applied to window sash and bearing against the window frame to prevent the sash from falling, were or are mechanical substitutes for catches or latches taking into notches, when forced by a spring or weight.

Ans. I do not consider them mechanical substitutes now, and did not previous to 1849. In my opinion they are not mechanical substitutes.

Int. 29. State whether or not the kinds of pattern mechanism represented in Model 5 and Model A are or not both pattern devices composed of removable sections suitable for moving jacks in a fancy loom such as is represented by Model A, and capable of variations by changing their removable sections so as to vary the pattern woven.

Ans. They are.

Int. 30. State whether or not the number of changes which can be

made in the pattern by Model 5 without the addition of a single
391 cam section besides those now in that model, and without the alterations in the form of any of them, is large or small, or how otherwise.

(Objected to.)

Ans. It is very large.

And in answer to cross-interrogatories propounded to him by Causten Browne, esq., of counsel for complainant, deponent saith:

Cross-int. 1. In your answer to the 5th direct interrogatory, you state that the Marshall loom at Worcester, on the 11th and 12th days of February, when you and others whom you mention, witnessed its operation, was operated by a woman, whose name you do not know, "assisted by Mr. Wyman;" what do you mean exactly by that? What are you willing to swear you saw Mr. Wyman do?

Ans. I saw Mr. Wyman fixing and adjusting the loom when it broke down during its operation. Moreover, when it was turned by hand, he turned it and the woman put the shuttle through the shed. I don't recollect of any other particular things he did. He was close at hand overseeing the operation of the loom.

Cross-int. 2 What do you mean exactly by the words, "Fixing and adjusting the loom when it broke down?" What are you willing to swear you saw Mr. Wyman do?

Ans. I was standing a little way from the loom, conversing, when the loom stopped. I don't know exactly what was the matter with it, but I saw Mr. Wyman after the loom stopped, at work on the loom with a wrench, and also looking at some of the parts of the loom; and then he and the girl together started it. I saw him at work at the mechanism for throwing the shuttle. Whether he did anything else I don't know.

Cross-int. 3. I don't understand from your last answer whether you mean to speak of two separate times when you saw Mr. Wyman at work on the loom, or whether your two references to his so doing are to one and the same instance; how is that?

Ans. The matters referred to in my last answer were one occurrence.

Cross-int. 4. Now, as to this one occasion on which you saw Mr.
392 Wyman at work on the loom; what part of the loom was he at work on?

Ans. I cannot point out the part, but it was something connected with the mechanism for throwing the shuttle, as I understood it.

Cross-int. 5. Was it not this—that the roller, which struck against the wing P (see Fig. 1 of the Marshall drawings) for working the picker staff, fell off, by reason of the nut becoming loose, and that Mr. Wyman replaced it?

Ans. I don't know. I didn't look closely to see what was the matter. I don't see how it could have been, if it was made like this drawing, because the roller in this drawing is held on its shaft by a sort of lynch pin and not by a nut; but from what occurred at that time it might have been so, if the roller was secured by a nut instead of a lynch pin, or it might have been that the stud on which the roller turns (which in this drawing is secured to its crank by a nut) came out.

Cross-int. 6. Then this coming out of the stud on which the roller P turns (which might have been the work you saw Mr. Wyman engaged upon) is what you meant, is it, when you answered to my first cross-interrogatory thus: "I saw Mr. Wyman fixing and adjusting the loom when it broke down during its operation?"

Ans. Yes; but I don't wish to be understood as stating that it was

the fixing the roller and stud especially, for that I did not observe particularly. I saw him at work with a wrench at that part of the loom, as I have before stated.

Cross-int. 7. But you did mean, if I understand you, by his "fixing and adjusting the loom when it broke down during its operation," the work you saw him doing with a wrench, whatever that work was?

Ans. Yes.

Cross-int. 8. When he turned the loom by hand, as mentioned in your answer to the 1st cross-interrogatory, at whose request was it done?

Ans. I can't say at whose request. We wished the loom turned by hand, and were talking about it, when Mr. Wyman volunteered to do it and did it. During the time of its being turned by hand, he the pur-
pose of giving the holding shoulders of the jacks a greater
393 stopped and started turning it by hand, at the direction of some of us. Sometimes one and sometimes another would ask him to stop or start. I think I asked him once or twice, and that Mr. Edward Renwick and Mr. Thomas also did so.

Cross-int. 9. You say in answer to the 24th direct interrogatory, that the curvature of the jacks in the Marshall loom at Worcester was nearly double that shown in the drawings of the Marshall patent. Do you mean double in length?

Ans. Yes.

Cross-int. 10. On how much in proportion of the entire curved part of the jack did the pattern rollers bear during their traverse—in the loom at Worcester, I mean?

Ans. I cannot say—I did not take notice.

Cross-int. 11. What did you mean by "mechanical substitutes," in your answer to the 28th direct interrogatory, as you used the term?

Ans. By mechanical substitutes, I meant to signify mechanical devices which may be substituted for other mechanical devices, and which are not necessarily equivalents of those other devices, but which will perform exactly the same thing or office, although not in substantially the same manner.

Cross-int. 12. Suppose a loom to be built in all respects according to the Marshall patent, including the evener, all the parts performing the duties respectively which you have attributed to them in your testimony. Then suppose that the proportions of certain parts be so altered that the loom weaves a narrower shed than before, all the parts with that exception performing the same duty that they did before; is it, in your opinion, substantially the same loom as it was before such alteration, or a substantially different loom?

Ans. That would depend upon circumstances. The question is very indefinite, and does not state whether the parts altered will perform or have capacity to perform additional duties or not in consequence of the alteration. If I could see the supposed loom referred to in the question, I might be able to give a more definite answer.

Cross-int. 13. Will you answer the question, assuming that the
394 parts do not perform or have the capacity of performing any additional duty?

Ans. I think the loom would then be substantially the same loom, provided that the alteration did not make the shed too narrow to weave practically.

Cross-int. 14. Will you now answer the same question, assuming that the parts not only perform the same duties which they performed before, but that some of them performed some duties which they did not perform before, would the loom, after the changes in question had been made, be a substantially different loom to what it was before?

Ans. If the alterations of some of the parts were of such a character as to dispense with the necessity of the use of one or more of the other parts in the practical operation of the loom, it would be, in my opinion, substantially different; because said part or parts, before active, would then become mere surplusage. If, however, the alterations were not of such character as to dispense with the necessity of the use of one of the parts, but by reason of such alterations the part so altered would perform additional duties, the combination would then be substantially different, to the extent of said alterations and the additional functions and effects produced thereby, but would contain within it the former combination.

Cross-int. 15. Take as the first loom in the comparison the Marshall loom, as you saw it at Worcester, and, for the second loom the said Marshall loom unaltered in any respect, except that the holes in the heddle levers (upper and lower) are made nearer the centre of the loom, and that their pivots are adjusted to the new position of the holes. Will you say whether those two looms are substantially the same or substantially different, giving, if you can, a direct answer?

Ans. Do you mean to have the axles and holes of both series of levers moved the same distance?

Cross-int. 16. I will ask you this question. If you do move them the same distance, will the loom work at all?

Ans. That will depend on how much you move them.

395 Cross-int. 17. If you move them sufficiently to make the shed $\frac{3}{4}$ of an inch narrower?

Ans. I cannot say. The upper and lower series of levers are of different lengths. Their pivots are not vertically under each other, and their axes are not arranged at the same proportional distance from their connections at the ends. And upon the adjustment of these pivots with relation to the length of the levers, the practical operation of the incline or oblique connections from the jacks to the lower series of heddle levers depends in a great measure. A change in the point of suspension of one or both of the series of levers, would, in my opinion, affect the action of the oblique connection upon the jacks in a greater or less degree.

Cross-int. 18. Do you not know how far the points of suspension of the upper and lower heddle levers, respectively, should be moved in order to reduce the shed $\frac{3}{4}$ of an inch?

Ans. No; I could not tell without measuring the loom inquired of.

Cross-int. 19. If the loom should be measured the problem would not be very difficult, would it?

Ans. It probably would not, to get the effect alone mentioned in the question, but it would probably involve some other changes to make the loom practically operate with that effect, but of this I am not certain without a practical experiment.

Cross-int. 20. Now assume that a constructor measured the loom, solved the problem above mentioned, and changed the points of suspension of the upper and lower heddle levers respectively, so far as to reduce the shed $\frac{3}{4}$ of an inch; would the loom then be substantially different from what it was before?

Ans. I don't know that it would; and answer that it would not, in my opinion, unless the change rendered the oblique connections practically inoperative or seriously impaired their efficiency. Assuming that they were not effected by the change, I think the loom would be the same as before in substance, providing also that the shed was before wide enough to admit of such alteration without rendering the loom practically inoperative.

Cross-int. 21. But whether the change would seriously impair
396 the efficiency of the oblique connections, you are not certain without a practical experiment, are you?

Ans. No.

Cross-int. 22. (De bene.) Does the drawing Exhibit No. 11, which shows the pattern mechanism of the cam loom Model 5 applied to select the jacks of Model A, in lieu of the pattern mechanism contained in Model A for that purpose, show a combination of parts for forming and shifting the shed which is substantially the same as that of Model A as it now stands; or does it show one which is substantially different?

Ans. It represents the parts which are the elements of the combination for forming and shifting the shed in Model A except the pattern chain; but it does not show those parts, all of them, in their proper positions, for instance, the evener is shown in this drawing as thrown out of range of the lance heads of the upper series of heddle levers, when it should have been shown as thrown in under the heddle lever represented in the drawing and holding it up; because the jack in the drawing is shown as thrown off, or away from, the upper catch. The drawing appears to me merely to show the application of a pattern mechanism like that in Exhibit 5 to select and move the jacks of model Exhibit A laterally, and does not, in my opinion, for the reasons I have stated, show substantially the same combination.

Cross-int. 23. Assume that the drawing is so corrected as to show the parts you speak of in their proper position, and answer the last question.

Ans. In my opinion, the combination would be substantially the same, assuming no change from Model A except in the pattern mechanism, because that has substantially the mode of operation of the pattern mechanism of Exhibit A, when in the same combination. The pattern mechanism of Exhibit 5, and shown in this drawing, is a pattern mechanism of removable cams placed upon cam carriers, and having the capacity of varying the position of the movable cams upon said cam carriers to vary the pattern woven. These removable cams, or protuberances, act to select the jacks, when they are brought opposite to their respective jacks, and also to move them laterally against the ten-
397 sion of the spring connections, and further to hold said jacks in their positions, when depressed with their holding shoulders under the lower series of spring latches, so long as a succession of such cam protuberances occurs on the cam carrier. When these protuberances cease, the jacks will be drawn out by the spring connections by reason of a depression coming opposite to them, and released from the spring latch so as to be elevated by the lifter, and will remain in their elevated position over the upper catch until a cam protuberance again occurs. Now all these operations are performed by the roller cams or protuberances on the cam carriers of the pattern chain in Model A. The form of the cams and cam carriers in each of the two pattern mechanisms differing, but in both cases the mode of operation is that of revolving cam protuberances and depressions applied to determine the pattern by selecting the jacks.

Adjourned to 2½ p. m.

Resumed: FEB. 25, 1867.

Cross-int. 24. About how many minutes did it take, after the wrench was procured, to do the work which Mr. Wyman was doing with the wrench as mentioned above by you?

Ans. I cannot say—not many—perhaps five minutes.

Cross-int. 25. Will you look at Exhibit P (being a sash stopper), and describe how it is to be applied to hold a sash up?

(Objected to).

Ans. It is to be applied to the window frame so that when the sash is lifted up above it the bottom of the sash may rest upon the latch, or so that the latch may be thrown into a notch cut into the side of the window sash. This is a spring latch. Its mode of operation is to latch or lock a window sash by projecting into the sash or underneath it.

Cross-int. 26. May there be as many notches in the side of the sash as you wish, to hold the sash at corresponding elevations?

(Objected to).

Ans. That will depend upon how many corresponding elevations you wish to hold the sash at. There must be some distance between
398 the notches for strength of material. Practically but one or two notches are used for this sort of latches on account of cutting away the window sash. It would be impossible if one wished to hold the window, say at every quarter inch of its elevation, to do it with that latch.

Cross-int. 27. How long have you known such a sash stopper as Exhibit P?

(Objected to).

Ans. For 30 or 35 years.

Cross-int. 28. Please look at Exhibit Q, and describe how that is to be applied to a window frame to hold the sash at any desired elevation?

(Objected to).

Ans. It is to be screwed to the side of the window frame at such distance from the sash that the cam on it may be jammed up against the sash so as to hold it on the principle of a wedge. Its operation is in principle substantially the same as driving a wedge between the frame and the sash.

Cross-int. 29. When the cam on it is jammed up against the sash, is not the sash prevented from falling by the friction of the cam?

(Objected to).

Ans. I don't think it is by the friction. It is by its action as a wedge that it holds it up.

Cross-int. 30. How does a wedge act to hold the sash up when driven in between the sash and the frame, if not by friction?

(Objected to).

Ans. It acts by causing the opposite side of the sash to be forced so strongly against its frame as to make more friction between that side of the sash and its frame than there was before, and thus hold it up.

Cross-int. 31. Does not the side of the sash opposite to that which makes friction on its frame, make friction on the wedge, or the wedge on it?

(Objected to).

Ans. Some.

Cross-int. 32. Can there be any friction between the sash and
399 frame on one side, unless there be friction between the sash and the wedge on the other side?

(Objected to).

Ans. No; but the wedge multiplies the friction and multiplies the force.

Cross-int. 33. Will the cam action, as described, of Exhibit Q hold the sash at any point of elevation at which it may be placed so that the cam will act against the sash?

(Objected to.)

Ans. I think it will if properly applied.

Cross-int. 34. How long have you known such a sash stopper as Exhibit Q?

(Objected to).

Ans. I can't say. I have known similar ones for a good many years.

F. C. TREADWELL, JR.

Adjourned to 26th inst., at 10 o'clock, a. m.

Deposition of Merrill D. Richardson, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 26*th*.

Int. 1. State your name, age, residence, and occupation.

Ans. Merrill D. Richardson; age, 42 years; residence, Glenham, N. Y.; occupation, superintendent of a woollen mill.

Int. 2. State of what mill you are superintendent, and where it is situated, and how long you have been such superintendent.

Ans. It is called the Glenham Woollen Mill; in the town of Fishkill, Duchess Co., N. Y. I have been superintendent since two years last January.

Int. 3. State whether or not you have ever been a practical weaver; and, if so, for how long.

Ans. I have; for about fifteen years.

400 Int. 4. State whether or not said company, the Glenham Woollen Mills, ever purchased of the Riverside Mills, at North Providence, R. I., any Thomas open-shed fancy looms. If yea, how many, and about how long ago?

Ans. They purchased thirty, in September, 1865.

Int. 5. Who negotiated the purchase in behalf of the Glenham Woollen Mills?

Ans. I did.

Int. 6. Where have said thirty Thomas open-shed fancy looms been since the purchase, and whether or not they have been used since that time, and, if so, how constantly?

Ans. They have been used all the time at the Glenham Woollen Mills.

Int. 7. Please state what has been their operation with reference to giving satisfaction or otherwise.

(Objected to).

Ans. They have given entire satisfaction.

Int. 8. What kind of goods have been woven on said looms since they have been in the Glenham Woollen Mills?

Ans. Different kinds of fancies, from 4 to 16 harnesses—beavers and plain goods, such as sackings, Meltons, &c.; heavy and light goods from 8 to 32 oz.

Int. 9. About how heavy, compared with the heaviest kind of goods, are goods containing 32 ounces?

Ans. We don't weave anything any heavier than 32 ounces.

Int. 10. Has there or not been any difficulty in weaving on said looms any kind of goods or pattern that you desired to weave?

(Objected to).

Ans. There has not.

Int. 11. How many harnesses were said looms capable of running?

Ans. Twenty-four.

Int. 12. What is the greatest number of harnesses that you have seen on the Crompton close-shed loom?

Ans. I think twenty. I don't know that I've seen any more. I don't recollect about that positively.

Int. 13. Have the said Thomas looms been operated on army goods since at the Glenham Mills?

401 Ans. No, sir.

Int. 14. State whether or not at said Glenham Mills there are any Crompton close-shed looms; and if so, how many?

Ans. There are, I believe, fifty or fifty-two.

Int. 15. Have you ever found any pattern that you desired to weave in a fancy loom that you could not weave on said Thomas looms?

(Objected to.)

Ans. I have not.

Int. 16. State how the cost and time of taking care of and repairing said Thomas looms compares with the cost and time of taking care of and repairing said Crompton looms.

(Objected to.)

Ans. I should think it was much less in the Thomas loom.

Int. 17. In respect to weaving tender warps and other kinds of warps, how do said Thomas looms compare with said Crompton looms?

(Objected to.)

Ans. Take good warps, I don't think there is much difference. Tender warps, I think, will weave better on the Thomas loom—easier motion.

Int. 18. Did you ever make a trial on the Crompton close-shed loom, and on the Thomas open-shed loom, of a tender warp of the same kind; and if so, about how long ago, and with what result?

(Objected to.)

Ans. I did. We had three warps of the same kind; we put one of 'em into a Crompton loom and one into a Thomas, and picked two of the best girls we had in the room, and put one girl on each loom. The result was that on the Thomas loom we wove eight yards, and on the Crompton five, per day. This was, I should think, ten years ago, more or less; I can't say exactly.

Int. 19. Why could not more than that amount per day be woven on said looms?

(Objected to.)

Ans. The yarn was tender.

Int. 20. How was it as to the breakages of this yarn as compared with other warps?

(Objected to.)

Ans. It was much more, of course.

402 Int. 21. Upon what depends the number of yards that can be woven per day, supposing, of course, the weaver operating the looms is a competent weaver?

Ans. Upon the number of picks per inch.

Int. 22. Does the tenderness of the warp and its liability to break affect the question of the number of yards to be woven in a given time?

Ans. Yes, sir.

Int. 23. Were or not the warps that were thus tried on the Crompton loom and the Thomas loom warps which had been condemned as too tender to be used?

(Objected to.)

Ans. They were considered to be very tender warps.

Int. 24. Was there any difference in the two warps that were put, one on the Crompton loom, and the other on the Thomas loom?

Ans. They were of the same lot.

Int. 25. State how, with respect to fairness, the test was made, that you have spoken of, on the Crompton and Thomas looms.

(Objected to.)

Ans. I considered it a fair test.

Int. 26. State whether or not there has been any difficulty at said Glenham Woollen Mills in getting hands to work on said Thomas looms.

Ans. There has not.

Int. 27. Who run said Thomas looms at said Glenham Woollen Mills; girls or men? How many of said Thomas looms can one hand there usually run?

(Objected to.)

Ans. Girls run them. Some girls run two looms.

And in answer to cross-interrogatories propounded by Causten Browne, esq., deponent saith as follows, viz.:

Cross-int. 1. What did the Glenham Woollen Mills pay for the Thomas open-shed fancy looms which they bought in September, 1865?

Ans. Three hundred dollars apiece.

403 Cross-int. 2. Who negotiated the sale on behalf of the Riverside Mills?

Ans. Chapin and Downs both were present at the time.

Cross-int. 3. Have the Glenham Woollen Mills bought any fancy looms since that time?

Ans. They have not.

Cross-int. 4. When did they buy the fifty or fifty-two Crompton close-shed looms which they now have?

Ans. I don't know.

Cross-int. 5. How long ago do you know them to have been in the mill?

Ans. They were there before I came there; that's all I can tell you about it.

Cross-int. 6. (De bene.) Where was the trial made that you spoke of in your answer to 18th direct interrogatory?

Ans. It was made in Lawrence, Mass.

Cross-int. 7. (De bene.) At what mill?

Ans. The Bay State Mills, I think they were then; now, the Washington Mills.

Cross-int. 8. (De bene.) Who was the agent and superintendent of that mill at that time?

Ans. Capt. Fox, I think.

Cross-int. 9. (De bene.) Who conducted or took part in this experiment?

Ans. I conducted it.

Cross-int. 10. (De bene.) By whose direction?

Ans. By my own, and I think Mr. Thomas wished to try to see which would weave the warp the best.

Cross-int. 11. (De bene.) Was Mr. Thomas at that time connected with that mill?

Ans. He was, I think, getting up his loom at that time. I don't know whether he was connected with the mill.

Cross-int. 12. (De bene.) What was your position in the mill?

Ans. Overseer of the room.

Cross-int. 13. (De bene.) Where was Mr. Thomas getting up his loom; was it in that mill?

404 Ans. I think so. I'm not certain about it.

Cross-int. 14. (De bene.) And did you, being only the overseer

of the room, cause a trial to be made between the two looms, without directions from any officer of the mill?

Ans. Yes, sir.

M. D. RICHARDSON.

Deposition of D. H. Kelly (recalled), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEBRUARY 26, 1867.

Int. 1. Have you given a previous deposition in this case?

Ans. I have.

Int. 2. Please state what description of goods you have woven with the Thomas open-shed fancy looms, at the Washington Mills, Lawrence; particularize the various kinds.

(Objected to.)

Ans. Shawls, tricots, diagonals, fancy kerseymeres, Moscow beavers, Esquimau beavers; those are the principal kinds.

Int. 3. How, with reference to satisfaction, have said looms woven these different kinds of goods that you have named?

(Objected to.)

Ans. They have woven them with good satisfaction.

Int. 4. State whether or not there is any kind of goods or any pattern of goods desirable to be woven on a fancy loom which cannot be woven on the Thomas open-shed fancy loom.

(Objected to as leading and incompetent.)

Ans. There is not.

Int. 5. State whether or not the Thomas open-shed fancy looms have been run on army goods at the Washington Mills.

(Objected to.)

Ans. I think they have not.

Int. 6. Did you see the so-called Marshall loom said to have been built by Mr. George Crompton, or by his direction, operated at Wor-
405 cester without the evener, and if so when? And state what you observed in its operation without the evener.

Ans. I did see it operated without the evener. It was the 22d and 23d days of the present month; last Friday and Saturday. I observed, in the first place, that the wires which connected the jacks to the levers on the bottom, had to be so tight to hold the jack on to the spring catch, that the ball on the pattern chain in knocking the jack from the catch, would soon wear the catch rounding, and render the jacks useless. I noticed that the box that holds the spring catches was imperfect; the least friction caused by those catches getting dry, or gummed up with oil, would cause them to stay back; and if one of those did not operate, it would make the whole of them useless. Also the lifter and depresser in operating; the lifter raised all the jacks three-eighths of an inch from the spring catch every time the shuttle picked across; they would drop back on to the catch, which would cause the harnesses to be in a trembling motion every time it picked across. The depresser operated in the same way; it carried them down three-eighths of an inch below the spring catches, and they would come back on the spring catches the same as the others, which would make it very difficult to weave a tender warp. When the lathe was forced up against the cloth, a part of the sheds were open, and a part nearly closed. Those that were open had the full strain of the lathe, while of those that were partly shut, the yarn was very slack; consequently it would be very hard to weave a tender warp in the loom, as you could not get the greatest strain on the yarn on all the harnesses at once. The jacks would frequently miss, drop off

the catch, and trap the shuttle as it was passing through the shed. I saw it weave fifteen inches of cloth in about thirty minutes. It caught the shuttle several times; twice within ten minutes. I saw wove in all about two yards with different pattern chains. The two yards that I speak of was very imperfect indeed, very; and we found on the loom six yards of cloth woven, with eleven imperfections caused by the mis-picks.

Int. 7. State whether or not any of the jacks were changed while you saw said loom operated; and if so, for what reason, if any, was the jack changed?

406 Ans. I think not.

Int. 8. State whether or not any preparation was made with reference to changing the jacks. If so, what and why?

Ans. I think there was. There was a jack sent over by Mr. Crompton, I think, while we were there. Some of the catches on the jacks had commenced to wear, and we thought it would be necessary to change one of them. It was not changed.

Int. 9. What did you notice, if anything, in respect to the wearing off of those shoulders on the jacks which engaged with the spring latches?

Ans. The jacks would miss very frequently with those worn off. I noticed they were wearing off.

Int. 10. State what utility, if any, said loom would have or possess, for weaving purposes.

Ans. I should think it would not have any, practically.

Int. 11. State whether or not said loom, in your opinion, is good for anything as a loom for weaving purposes.

Ans. It is not, in my opinion.

Int. 12. Who operated said loom while you saw it run without the evener?

Ans. A Mr. Scofield, most of the time, a superintendent from Messenger & Wright's Mill, in Worcester.

Int. 13. By careful attention, might or might not one or more yards be woven on said loom?

Ans. Yes, sir; there could.

Int. 14. Did you observe whether anything had been done to the shuttle in that loom?

Ans. I think the front side of it had been planed off.

Int. 15. What effect would such planing off have upon the shuttle in reference to enabling it to get through the shed?

Ans. It would give it more room. It would pass through easier.

And in answer to cross-interrogatories by Causten Browne, esq., deponent saith as follows:

Cross-int. 1. Which of the jacks was it on which the catches

407 had commenced to wear, so that you thought it would be necessary to change it?

Ans. I think the third one from the lathe.

D. H. KELLY.

Adjourned to 2 p. m.

Deposition of Robert Davis (recalled), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 26, 1867.

Int. 1. Please state whether you have been previously examined in this case.

Ans. I have.

Int. 2. State whether or not you have seen the Crompton open-shed fancy loom operated. And if so, about how long ago for the first time?

Ans. I have. For the first time in 1863.

Int. 3. Where?

Ans. At the Washington Mills, Lawrence, Mass.

Int. 4. How did it operate, with reference to success, as compared with the Thomas open-shed fancy loom?

(Objected to.)

Ans. It was not so successful as the Thomas loom in weaving tender warps.

Int. 5. How did the quantity of work on the same fabric done on the said Crompton loom compare with the quantity of work on the same fabric done on the said Thomas loom?

(Objected to.)

Ans. On most fabrics we were able to weave more yards per day on the Thomas than on the Crompton loom.

Int. 6. Can you state as to any trial made on the same fabric in weaving on said Crompton loom as compared with the weaving on the same fabric on said Thomas loom?

(Objected to.)

408 Ans. Some fine fancy shirtings in the Crompton loom didn't go very well. The warp was taken out of the Crompton loom and beamed on to a Thomas loom beam and put into a Thomas loom, and wove from four to five yards a day more in the Thomas loom than it did in the Crompton loom.

Int. 7. Why was the warp taken out of said Crompton loom and put on to the Thomas loom?

(Objected to.)

Ans. Because the motion of the Thomas loom was easier on the tender yarn.

Int. 8. State what kind of goods you have woven at the Washington Mills on said Thomas open-shed fancy looms. Particularize the kinds.

(Objected to.)

Ans. Heavy Moscow beavers, heavy Esquimau beavers, fancy kerseymeres of single and double twist yarn, silk-mixed Coddrington, mixed paletots, Scotch tweeds. That is all I think of at present; there are others that we have manufactured years ago, but I have forgotten the names of them.

Int. 9. Has the manufacture of these been under your supervision, or in a department that you had charge of?

Ans. They have.

Int. 10. How successfully or otherwise have these kinds of goods which you have named been woven on said Thomas looms?

(Objected to.)

Ans. They gave perfect satisfaction.

Int. 11. State whether or not there is any kind of goods, or any pattern desirable to be woven on fancy looms, which you cannot weave on the said Thomas looms.

Ans. Not that I know of.

Int. 12. State whether or not you have used said Thomas looms on army goods.

Ans. No.

Int. 13. State whether or not you saw the so-called Marshall loom
409 said to have been made under the direction of Mr. George Crompton operated at Worcester, without the evener. If so, when, and what did you observe in its operation?

Ans. I did, on the 22d and 23d insts.; last Friday and Saturday. I observed in the operation of the Marshall loom that the lifting and depressing bar raised the jacks three-eighths of an inch above the spring catches, and it also carried them down three-eighths of an inch below the spring catches, which caused an unsteady motion of the harness—which is very injurious in weaving tender yarn—and also caused the jacks occasionally to slip off the spring catches. In so doing it would trap the shuttle in passing through the shed and throw it out sometimes, making imperfect cloth by so doing. I also observed when one of the spring catches got gummed up or dry for want of oil it would stick and cause the others to be of no use. Also, when the lay was up to the cloth, then the greatest tension or strain was on the warp. On this loom when the lay was up the sheds were not open, all of them, when they should be, and that part of the sheds that were open had the greatest tension or strain. Those that were not open were loose, which would be very injurious in weaving tender warp. I also found six yards wove with ten or twelve imperfections in it. I noticed one of the catches on the jack wore a little. During the time I was there Mr. Crompton sent a man with a new jack to put in place of that one that was worn, which we did not do. We wove about two yards with different pattern chains which was very imperfect, owing to the jacks falling off the spring catches.

Int. 14. Did you notice anything in respect to the tension or strain of the connections of the jacks to the lower series of heddle levers in that loom?

Ans. Yes. I noticed the tension was very great, which would wear out the catches on the jacks very soon, and also the tension did remove the pattern chain from its proper place.

Int. 15. State what, if any, utility for weaving purposes said loom has, constructed as you saw it, if used without the evener.

Ans. None.

Int. 16. State whether or not it has any practical use for weaving purposes.

410 Ans. It has not.

Int. 17. State whether or not you could weave cloth on it by careful attention; and if so, what would it require and how would you do it?

Ans. I could weave cloth in it by watching it closely, and when it made an imperfection stop it and pick out those picks that went in the wrong shed and run it until it made another imperfection. I think in this way I could weave a yard or two, but it would require some time to do it.

(Counsel for complainant declines to cross-examine.)

ROBERT DAVIS.

Deposition of Benjamin G. Adams, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 26, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. Benjamin G. Adams; age, 44; residence, North Salem, N. H.; occupation, weaver—overseer in a weaving room.

Int. 2. State what practical knowledge you have had in weaving, and how long.

Ans. I've wove most all kinds of woollen fabrics for about eighteen years—most of the time for eighteen years—some cotton.

Int. 3. State whether or not you saw in operation, without the evener, the so-called Marshall loom at Worcester, said to have been built from

the directions of Mr. George Crompton. If yea, when you so saw it in operation, and what you observed in its operation.

Ans. I saw it in operation last Friday and Saturday, 22d and 23d of February. It operated imperfectly. I noticed that the operation of the spring catches that held the jacks was imperfect. I noticed that they were liable to stick from friction for the want of oil, or from too much oil which would cause them to gum, and should one of those spring catches stick (I mean by sticking, if it should go back, which it has to do every time the jack passes up or down), should stay back, it
411 renders all of the rest useless. Also, I observed that the lifting and depressing bars carrying the jacks $\frac{3}{8}$ of an inch above and below the spring catches—falling back on them with a jerk or jar, a heavy jar, causing one or more of them to slip off at times; and that would cause the shuttle to pass through the wrong shade and would make in the cloth what we term a mispick. I also noticed that when it done that, or when the filling broke in the shuttle, causing a mispick, that it took a long time to find it. We put on a number of different pattern chains, and they did not any of them make what I call perfect weaving. We found also on the loom cloth wove imperfectly. Six yards was wove and eleven mispicks from the shuttle going through the wrong shade, and four other mispicks caused by the shuttles going through the shades as they fell off at times. The jacks are liable to wear—I mean the shoulders at the corners—from the fact the loom is not timed well, the way I saw it, the pattern chain not removing the jacks from the spring catches in time for the lifting and depressing bars to come round and carry them down, but striking them off from the spring catches, wearing off the shoulders; and one was worn a considerable, and a man brought in another jack, said to be Mr. Crompton's man, the weaver said, for him to put in in place of that. I asked him how many yards had been wove with the other jack—the one that was in; he said—(objected to by counsel for complainant)—about forty yards.

Int. 4. What struck the jacks off the spring catches?

Ans. The pattern chain would strike them off—that is, it was designed to do it.

Int. 5. You say "the pattern chain not removing the jacks from the spring catches in time for the lifting and depressing bars to come round and carry them down, but striking them off from the spring catches." Please explain what you mean by that.

Ans. I mean to say that they were not entirely relieved from the spring catches before the lifting bar or depressing bar hit them.

Int. 6. You say a number of different pattern chains were put on. Please explain what you mean by that. Whether the same kind of pattern chain was used but so set as to form a different pattern, or that a different pattern chain was put upon it?

412 Ans. There was a number of pattern chains made up for different patterns, and they were put on, and the loom run with each chain separately to see if it would make perfect cloth. The pattern chains were of the same description.

Int. 7. Were all these pattern chains composed of cam rollers and thimbles only varied in respect to the number of bars and the location of the cam rollers and thimbles?

Ans. They were.

Adjourned to 10 a. m., 27th inst.

Resumed: FEB. 27, 1867.

Int. 8. State anything you can in regard to said loom in its operation making mispicks, and in reference to the trapping of the shuttle.

Ans. I've said all in reference to mispicks. I saw the shuttle trapped three times.

Int. 9. How was the tension of the connecting wires connecting the lower ends of the jacks to the lower series of heddle levers, and what effect, if any, did the tension have upon the operation of the pattern mechanism?

Ans. The tension was very great. It would have a tendency to wear off the shoulders of the jacks, and also to wear on the balls of the chain. I also noticed that it was so great at times as to partially move the pattern chain out of its course.

Int. 10. State whether or not the mispicks made by said loom were frequent or otherwise.

Ans. When the weaver commenced to run it, they were frequent for a yard or so. The weaver then was instructed to alter it in the best manner he could, as though he was determined it should run. He made some alteration and it did not mispick so frequently.

Int. 11. Who was the weaver you refer to? Do you know his name?

Ans. Schofield.

Int. 12. State whether or not said loom, without the evener, has any practical value for weaving purposes.

413 Ans. I should say not any practical value.

Int. 13. Could you by careful attention and management weave some cloth on said loom without the evener; and in doing it what means and care would you have to take?

Ans. I could. When it made mispicks I should have to stop it, and when they had gone through the wrong shade pull them out and start again, and with plenty of jacks fitted in good order to replace those whose shoulders might be worn off.

Int. 14. Have you had any acquaintance with the Thomas open-shed fancy loom, and how long?

Ans. I have for about eight years.

Int. 15. Have you operated any of them; and if so, how many, and when did you first commence to operate them?

Ans. In 1856 I first commenced with one loom. In 1857 we commenced altering over the Thomas cam loom to the Thomas open-shed fancy loom. We altered about a hundred, or probably more. I operated them until January 10th, 1860.

Int. 16. Where was this, and what occurred at that date?

(Objected to.)

Ans. It was at Lawrence, at the Pemberton Mills. The Pemberton Mill fell down on that day.

Int. 17. Were you in the employ of the Pemberton Mills after that time?

Ans. I was not.

Int. 18. Have you had any acquaintance with the Thomas open-shed fancy looms since that time?

Ans. Yes, sir.

Int. 19. Where and in what places?

Ans. At Lawrence, at the Washington Mills.

Int. 20. How have said Thomas open-shed fancy looms operated, satisfactorily or otherwise?

(Objected to.)

Ans. I should say satisfactorily.

Int. 21. State whether or not those at the Pemberton Mills were run until the mill fell, or for a shorter time.

Ans. They run until the mill fell, with one exception. They
414 stopped a few months in consequence of hard times. The whole mill was stopped.

Int. 22. What number of harnesses have you run on the Thomas open-shed fancy loom?

Ans. Eighteen is the largest number.

Int. 23. What is the highest number of harnesses you ever run on the Crompton close-shed fancy loom?

(Objected to.)

Ans. Twelve.

Int. 24. Whether or not there are any kinds or patterns of fancy goods desirable to be woven on a fancy loom which you cannot weave on the Thomas open-shed fancy loom?

(Objected to.)

Ans. I should say not.

Int. 25. Have you had any experience in setting patterns on the old Crompton pattern chain composed of chain links, bars, cam rollers, thimbles, and pins; and any experience in setting patterns on the Thomas chain, the latter containing holes and covers, or buttons?

Ans. I have, on both.

Int. 26. Take the old Crompton pattern chain and the Thomas pattern chain, both set for the same pattern; will you then state, if you desire to change each of them to a same given pattern, how much time or trouble it takes you to so change them respectively?

(Objected to.)

Ans. It would take me ten times as long to change the Crompton as it would the Thomas.

Int. 27. State whether or not you know of any trial being made at the Washington Mills to run the Crompton open-shed fancy loom; and, if so, how long ago, or about how long ago was it, and who made the trial?

(Objected to.)

Ans. I know there was such a trial in May, 1860. It was made by a man sent there by Mr. Crompton to try his loom on his part, and by me to try Mr. Thomas's loom on the other.

Int. 28. Was the same or a different pattern put on each loom,
415 the Crompton open-shed fancy loom, and the Thomas open shed fancy loom?

(Objected to.)

Ans. The same.

Int. 29. How successful was the Crompton open-shed fancy loom in weaving out that pattern?

(Objected to.)

Ans. It was a failure.

Int. 30. Can you state whether or not the warp for that pattern was taken out of said Crompton open-shed loom?

(Objected to as leading and incompetent. Interrogatory withdrawn.)

Int. 31. What became of the warp for that pattern which was in the Crompton open-shed loom?

(Objected to.)

Ans. It was taken out of the loom, put into the Thomas, and wove up.

Int. 32. How did the Thomas open-shed fancy loom weave the same pattern which was put in it?

(Objected to.)

Ans. Well.

Int. 33. Can you state about how long Mr. Crompton's man was there testing the open-shed Crompton fancy loom?

(Objected to.)

Ans. He was there five days and a half after I went there.

Int. 34. Did you find him there when you went there at work on the loom?

(Objected to.)

Ans. Yes, I did.

Int. 35. State whether or not Mr. Geo. Crompton made any examination of the Thomas open-shed fancy looms at the Pemberton Mills while you were there, and, if yea, about what year was it?

Ans. There was a man there examining the Thomas open-shed fancy loom. I asked who it was; they said—(objected to)—it was Mr.
416 Crompton. I couldn't undertake to say certain what year, but I think in 1857 or 1858.

Int. 36. Can you state whether or not the gentleman now present, Mr. Geo. Crompton, was the person who made that examination?

Ans. I could not say it was he.

Int. 37. How much of an examination did the person make whom you have referred to?

(Objected to.)

Ans. I should say that he might have been there an hour—he might more.

And in answer to cross-interrogatories by Causten Browne, esq., deponent saith as follows, viz.:

Cross-int. 1. When did you go into the employment of the Washington Mills?

Ans. In 1860; the first Monday in May.

Cross-int. 2. And remained there until when?

Ans. Until 1866—the 1st of October.

Cross-int. 3. What were your duties?

Ans. I was overseer of two weaving rooms.

Cross-int. 4. Was this so during all the time you were in the mills?

Ans. Yes, sir. I was overseer of three part of the time.

Cross-int. 5. Did you have Crompton fancy looms in any of the rooms of which you were overseer?

Ans. I did.

Cross-int. 6. You said in answer to 26th direct interrogatory that it would take you ten times as long to change the Crompton pattern chain to a given pattern as it would to change the Thomas chain to the same pattern, each change being made from the same pattern; do you think other persons could do it in less time?

Ans. I think that some men might do it in less time?

Cross-int. 7. Did you ever do it at all?

Ans. Yes; a good many times; too numerous to mention.

Cross-int. 8. (De bene.) In the experiment you describe of try-
417 ing the Crompton open-shed loom and the Thomas open-shed loom together at the Washington Mills, about how long, if you remember, was the pattern chain which the Crompton loom carried to weave the pattern?

Ans. I should say it was twenty feet. It might have been more.

Cross-int. 9. (De bene.) Don't you think it may have been fifty feet long?

Ans. I don't think it was.

Cross-int. 10. (De bene.) By length of chain in my last two questions do you understand the length of the entire round of the chain?

Ans. That's the way I understand it.

(Counsel for defendants, stating that he omitted to ask the following question by mistake, now asks it.)

Int. 38. What finally became of said Crompton open-shed fancy loom?

Ans. With the consent of E. D. Thayer, the agent of the mill, I took off the fancy work, and changed it to a cam loom. It is running so now.

B. G. ADAMS.

Deposition of Robert Davis (recalled), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 27, 1867.

Int. 1. Have you previously testified in this cause?

Ans. I have.

Int. 2. State the number of harnesses on some of the Thomas open-shed fancy looms.

(Objected to.)

Ans. Twenty-four.

Int. 3. State, if the pattern requires it, how many of them can be successfully operated.

(Objected to.)

Ans. All of them.

Int. 4. What is the highest number of harnesses that you have known on the Crompton close-shed fancy looms?

(Objected to.)

Ans. Twenty-four.

418 Int. 5. State whether or not you have had any and what experience in setting patterns to be woven on fancy looms.

(Objected to.)

Ans. I have had experience in setting patterns on the Thomas fancy loom, on the Crompton fancy loom, and on the Greenhalgh fancy loom.

Int. 6. Take a loom like Model A, with the number of bars (8) in the pattern chain, which it now has, and the number of heddles (4) which it now has, with the liberty to vary the number of cam rollers and thimbles as you please, and to the greatest extent, by the addition of cam rollers or thimbles, or either, but within the limits of eight bars on the pattern mechanism and four heddles, and state whether or not you could then weave on that loom either three-leaved twills, five-shaft satteens, five-shaft doeskins, or corduroys, or velveteens.

(Objected to.)

Ans. You could not.

And in answer to cross-interrogatories propounded, de bene esse, by Causten Browne, esq., deponent doth depose and say as follows:

Cross-int. 1. Please state what you understand to be the texture of the goods you call corduroys and velveteens.

Ans. Well, there is light and heavy of both.

Cross-int. 2. When I say texture, I don't mean weight. What is the texture of the goods in question? If you don't know what the word means, please say so.

Ans. The texture of the goods is soft and of light appearance—glossy appearance.

Cross-int. 3. How are these goods produced? In what order of picks?

Ans. They are produced by fancy looms. I can't enumerate all the orders of picks—different orders—there are different fabrics of them.

Cross-int. 4. Do you mean to say that you cannot give any more intelligible description of what weavers mean by the fabrics called corduroy and velveteen than you have given?

Ans. No; I cannot.

419 Cross-int. 5. How much space do the harnesses occupy from back to front of the loom in the Crompton close-shed loom?

Ans. I never measured. I don't know.

Cross-int. 6. Suppose twenty-four harnesses in a Crompton close-shed loom, and twenty-four harnesses in a Thomas open-shed loom; do you know in which of the two looms the harnesses occupy the most space from back to front of the loom?

Ans. I think the Thomas occupy a little more than the Crompton; a very little.

Cross-int. 7. Don't you know that they occupy as much as one-third more space?

Ans. I think not.

Cross-int. 8. What do you understand by a three-leaved twill?

Ans. The warp drawn in three sheds and wove with two up and one down while the shuttle is passing; or with two down and one up—changing from one to two and three, each one taking their turns—a regular change.

Cross-int. 9. What do you understand by a five-shaft satteen?

Ans. Satteens are generally wove on five shafts; what I have seen has been wove on five shafts.

Cross-int. 10. By five shafts do you mean five harnesses?

Ans. I do.

Cross-int. 11. You stated the order of picks in weaving three-leaved twills. Will you now state the order of picks in weaving five-leaf satteens, or five-shaft satteens, or five-harness satteens, whichever term you prefer?

Ans. A regular order from one to five.

Cross-int. 12. Can't you convey a little clearer idea of it than that?

Ans. No. 1, harness down; 2, 3, 4, and 5 up; one up, two down, three, four, and five up, and so on till we get the round of five rounds. That's the way I have seen them wove.

Cross-int. 13. Are five-shaft doeskins woven according to the same method as to succession of harnesses?

Ans. Doeskins are wove 1 harness down on the first pick, 2, 3, 4, and 5 up; 1 and 2 harness up, 3 down, 4 and 5 up; 1, 2, 3, 4 up, and

420 5 down; 1 up, 2 down, 3 up, 4 up, 5 up, 1, 2, 3 up, 4 down, and 5 up; that's the round for five rounds of doeskin, I believe.

Cross int. 14. Now can't you tell us the method of weaving corduroys and velveteens as regards the succession of harnesses.

Ans. The corduroys that I've seen wove were wove on eight harnesses; but I do not remember the rising and falling of them during the round—not accurately—velveteens on five harnesses, as I said before, with five changes to the round. This is the kind I've seen wove.

ROBERT DAVIS.

Deposition of Jonathan E. Chase, taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEBRUARY 27, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. Jonathan E. Chase; age, 45; residence, Lowell, Mass.; occupation, manufacturer.

Int. 2. In what particular department of manufacturing have you been engaged, and what have been your duties while so engaged?

Ans. I've had charge of a weave room part of the time, and part of the time have superintended the entire mill.

Int. 3. Have you had any and what experience as a practical weaver, and during what period of time?

Ans. As I said, I have had charge of a weave-room, and have done the designing for the last twelve years.

Int. 4. In what mills have you been engaged or employed?

Ans. In the Merrimac Woollen Mills, Dracut, for eight years. I was in Messenger & Wright's Mill, Worcester, four years and a little over. I have been at Lowell, at the Chase Mills, since the first of August last.

Int. 5. Have you had any acquaintance with the Crompton open-shed fancy looms; and if so, where?

Ans. I have. We had six of them at Dracut, Merrimac Woollen Mills, We had one at Worcester, Messenger & Wright's.

421 Int. 6. Have you at any time altered any, and, if so, which of said Crompton open-shed looms? If yea, in what respect?

(Objected to.)

Ans. I have altered the open-shed looms to a Crompton close-shed. I can't say positively how many. I altered some at Dracut, and the one at Worcester.

Int. 7. Did you alter into a Crompton close-shed loom all said open-shed looms that you altered, or only a part of them?

(Objected to.)

Ans. I altered only a part of them at Dracut; but all I altered I altered into a close-shed loom, as well as the one at Worcester.

Int. 8. Were you acquainted with Mr. George Crompton, the complainant in this case; and, if so, how long have you known him?

Ans. I have known him some eight or ten years; but have been more particularly acquainted with him for the last four or five years, since I have been in Worcester.

Int. 9. State whether or not said George Crompton, since you left Dracut, and, if so, when or about what time, or about how long ago it was, had any conversation with you in regard to his open-shed fancy looms. If yea, please state the conversation.

(Objected to.)

Ans. I've talked with him a number of times in regard to looms of different kinds. I can't tell how long ago it was, because we've had so many conversations—perhaps a year, or a year and a half, or two years ago. I've had conversations with him in regard to the open-shed loom about the time I altered the one over in Worcester—I think somewhere about the time. I told him that I didn't like the loom, and on some patterns it did not work well; and he said that the loom he didn't think was as good as his others, and he shouldn't make any, unless persons ordered them especially. He didn't calculate to make any more unless some one ordered them.

Int. 10. Did he in that conversation state anything, and, if so, what, as to what his advice was to persons wanting looms?

Ans. I think he said that he shouldn't advise any one to buy the open-shed looms, but should advise the close-shed in preference to them.

Int. 11. About how long ago was this conversation?

422 Ans. Well, I suppose it was two years; I couldn't state exactly how long; it may be two years.

And in answer to cross-interrogatories by Causten Browne, esq., deponent saith as follows, viz:

Cross-int. 1. On what patterns did the Crompton open-shed looms not work well?

Ans. They don't work well where you want to make an entire change; take a tricot weave, for instance.

Cross-int. 2. Do you mean by making an entire change that all the harnesses which were up go down, and all which were down go up at the next pick?

Ans. I do.

Cross-int. 3. Will you look as the piece of goods now shown you, marked Exhibit G, N. A. P., Ex'r, and say whether, in weaving such goods with the Crompton open-shed looms at Dracut or Lowell, the filling was liable to kink?

Ans I never wove on an open-shed loom at Lowell. At Dracut and Worcester I have. I don't think that weave would kink. I could tell better if I was to pick it out.

And in answer to direct interrogatories resumed by J. D. Ball, esq., deponent saith:

Int. 12. What were the difficulties attending the working of the Crompton open-shed loom referred to in your answer to the first cross-interrogatory?

Ans. When the loom made an entire change of harness, we couldn't get a clear shed so but what the filling would kink and make the cloth rough and nubby.

J. E. CHASE.

423 *Deposition of William Wiesner, taken, subscribed, and sworn to before N. Austin Parks, examiner.*

FEB. 27, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. William Wiesner; age, 40; residence, Methuen, Mass.; occupation, overseer in a weaving room at the Washington Mills.

Int. 2. State whether or not you are a practical weaver, and whether or not you have had any experience, and, if so, for what period of time, as a loom fixer.

Ans. I am a practical weaver. I did fix looms nearly five years.

Int. 3. Have you been a loom fixer on the Thomas open-shed fancy looms and the Crompton close-shed fancy looms?

Ans. I have.

Int. 4. How does the time, cost, and trouble of fixing and repairing said Thomas looms compare with the time, cost, and trouble of fixing and repairing the Crompton close-shed fancy looms?

(Objected to.)

Ans. Well, it costs twice as much time to prepare a Crompton close-shed loom as a Thomas open-shed loom. I mean it takes twice as much time to bring the loom in motion.

Int. 5. How does the number of Thomas open-shed fancy looms, which a loom fixer can take care of, compare with the number of the Crompton close-shed fancy looms that he can take care of in the same space of time?

Ans. Well, I go by my own judgment. I would rather run twenty Thomas open-shed looms before I would run fifteen Crompton close-shed looms.

And in answer to cross-interrogatories by C. Browne, esq., deponent saith:

Cross-int. 1. Are the Crompton close-shed looms, which you speak of as in the Washington Mills, narrow looms?

Ans. Narrow looms.

Cross-int. 2. Do you know whether those narrow looms bore the mark of Mr. Crompton as the builder of them?

424 Ans. One of them was Mr. Crompton's build; the rest were changed over into the Crompton motion.

Cross-int. 3. Who made that change?

Ans. It was made in the Washington Mills repair shop.

Cross-int. 4. Are there not, or have there not been, in the Washington Mills some narrow close-shed Crompton looms, which were built so, and not altered from something else into close-shed looms?

Ans. One loom was there built by Mr. Crompton, and not altered by anybody.

Cross-int. 5. How long have you been in the Washington Mills?

Ans. Since 1859 and 1860—ever since the corporation started.

Cross-int. 6. Were there not in that mill when you went there, or soon afterwards, a large number of narrow close-shed fancy looms?

Ans. Well, at the time I came there, it was just the time they had changed them over, and they had only one Crompton close-shed fancy loom.

Cross-int. 7. Changed what over? What looms did they change, and what did they change them into, about the time you went there?

Ans. Well, this kind of loom they changed over they called them always "old chain looms." When they made them, I can't tell that. They changed them into pick-and-pick Crompton motion.

Cross-int. 8. How many of these looms were there which were changed over into pick-and-pick Crompton looms?

Ans. Thirty.

Cross-int. 9. Are these the Crompton close-shed looms you were speaking of when you testified about the time, cost, and trouble of fixing and repairing the Crompton close-shed fancy looms, and about the number of Crompton close-shed fancy looms a fixer could take care of in a certain time?

Ans. Yes, these are the looms. I had amongst this number one open-shed loom.

Cross-int. 10. These looms were altered into the pick-and-pick Crompton loom in the Washington Mills, were they?

Ans. Yes, sir.

WM. WIESNER.

Adjourned to 2¾ p. m.

425 *Deposition of James Schofield, taken, subscribed, and sworn to, before N. Austin Parks, examiner.*

FEB. 27, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. James Schofield; age, 29; residence, Worcester, Mass.; occupation, manufacturer.

Int. 2. State what department of manufacturing you have been engaged in from time to time.

Ans. In the weave-room mostly.

Int. 3. State what experience you have had in weaving, and when you began, and how long in all you were engaged in it.

Ans. I've been engaged in it ten years. I began in 1847, or about that time. I've been three years in the army.

Int. 4. What is your present business, and are you engaged in any mill; if so, in what?

Ans. I am superintendent of Messenger & Wright's Woollen Mill, in Worcester, Mass.; taking charge of the weaving department more particulary than any of the rest.

Int. 5. How long an experience have you had as a practical weaver?

Ans. Eight years, counting two years to become a practical weaver.

Int. 6. Have you ever seen or operated the so-called Marshall loom at Worcester, built under the direction of Mr. Geo. Crompton, the complainant in this case? If yea, how did you come to have anything to do with it, and when and what you did? And state its operation, and all you know in relation to it.

Ans. I have seen and operated it by request of Mr. George Crompton. I prepared a warp for the loom and drawed in upon eight harnesses, put it into the loom and started up with the pattern of what we call the plain, heavy weave. After starting it up, left it running in care of a girl weaver, under the direction of Mr. Wyman, who took charge of it after me. My attention was called to the loom again to cut off
426 that warp and redraw it into a twelve harness, for the purpose as stated to me—(objected to)—of weaving a fancy pattern (all my orders were stated to me as a general thing), to show that it was a fancy loom. One of the best loom-fixers which I have, put it into the loom and started it up, leaving it, as he thought, in condition to run. My attention was next called to the loom by Mr. Wyman in regard to its making mispicks. After consulting me about it he removed the comb, which is a guide to the jacks, for the purpose of cutting it deeper to allow the jacks to hook upon the front spring catches. Finding that did not remove the difficulty, I suggested that the eveners be made to operate upon the jacks quicker—sooner—which seemed to overcome the difficulty. This time I spent between two and three hours at the loom. I did not have anything more to do with it until called upon by Mr. Joseph Chase for the purpose of operating the loom for Mr. Thomas. Finding the loom without the evener to work, I objected to running it in that way, and was told that the loom was to be run without the eveners. I found that the sheds dropped upon the shuttle, and was directed by Mr. Thomas—(objected to)—to fix the loom if I could. I found that the tension of the harnesses, which was required to keep the jacks upon the front spring catches, had so much friction upon the chain as to draw it backward, which I overcome by putting more friction upon the chain to hold it in its place. After which it run as well as could be expected, or as I could expect, without those eveners. After weaving other patterns we took that warp out of the loom, I and the loom-fixer, and examined the cloth which was woven, and found many mispicks upon that woven before I went there, and a few mispicks that did not extend across the cloth on that which I did weave, showing that it was an imperfect shade that the shuttle passed through. Another warp was then put into the loom, differing from the other by its having a greater number of threads and being single yarn, on which we wove four different patterns; on some of the patterns this warp went very bad, throwing the shuttle out once by an imperfect shade. A jack was brought over by Mr. Wyman, who stated to me that the third jack from the front had a piece broken off from the back hook, and if it missed wished me to replace it by
427 a new one, but not seeing that the third jack from the front slipped from the spring catches more than the others, I allowed it to run as it was when I found it.

Int. 7. When you first went to operate that loom at the request of Mr.

George Crompton, did you have any difficulty, or had there been any difficulty in starting it?

Ans. None that I know of.

Int. 8. How did you find, at the time you first commenced to operate it, the tension of the wires which connected the jacks with the lower series of heddle levers?

Ans. I merely found the wires there ready to be used. When the warp is out the wires are slack.

Int. 9. How did you find the tension of these wires after you put the warp in and commenced to operate it?

Ans. We made them as tight as we possibly could.

Int. 10. For what purpose?

Ans. For keeping the jacks upon the front spring-catches.

Int. 11. Did you have to keep this tension much greater than you do in the close-shed looms?

Ans. We did.

Int. 12. Please examine Exhibits H, I, and G, and state what character of patterns they are as to ease in weaving.

Ans. G is the easiest pattern we have woven, and the girls make the best wages on it of any. H and I we consider easy patterns.

Int. 13. Did you put in the warps for those patterns in the said so-called Marshall loom?

Ans. I assisted in putting in the warp for pattern G. The warp for patterns H and I was put in by the best loom-fixer I had.

Int. 14. What can you say as to the practical utility of said so-called Marshall loom for weaving purposes when run with the evener?

(Objected to.)

Ans. I should take it if I could get no other.

Int 15. Upon what do you found your opinion of it in this respect?

(Objected to.)

Ans. Because I should be unable to get loom-fixers to run it,
428 and that I could not compete with any using any other fancy loom that I have ever worked upon.

Int. 16. What are the difficulties with it in its practical operations for weaving purposes?

(Objected to.)

Ans. The strong tension required on the harnesses causes the heddles to become tight upon the rods of the harnesses, which ought to play free and easy, thereby breaking out the warps. In the wear of the loom, which is greater on the harness motions than in any I have worked upon, making it far more expensive to run it.

Int. 17. How as to the certainty of action of the spring-latches?

(Objected to.)

Ans. I should not want to risk them for one day.

Int. 18. State how successful, or otherwise, was the operation of that loom without the evener.

Ans. I should never think of running them at all to any extent.

Int. 19. What, if anything, did you notice in relation to the certainty of action of the spring-latches in engaging with and holding the shoulders of the jacks when that loom was run without the evener?

Ans. I noticed a kind of a dancing, uncertain movement. They were liable to give way any time and drop one or more harnesses

Int. 20. Did you notice whether or not the jacks did get off of the spring-latches when they should have been retained there?

Ans. Upon one pattern, called the tricot pattern, they did get off before the shuttle was out of the shed.

Int. 21. What effect did that produce upon the shed?

Ans. It caused the shuttle to be thrown up against the top guide of the shuttle-box, thereby wearing the shuttles out, which would be the natural cause of breaking the warp. I have run a set of shuttles, in a loom somewhere eighteen or more years old, more than two years; and I believe that the Marshall loom, with the same patterns and same drop-boxes, would wear the shuttles out in three months.

Int. 22. State whether or not the said so-called Marshall loom, if run without the evener, has any, and if any, what practical value for weaving purposes.

429 Ans. I should take the Crompton close-shed loom in preference to that, paying the price for it, rather than the Marshall loom, without any price, if it was given me to weave with that shed motion.

Int. 23. Were you ever employed at Waterford, Conn.; and if yea, in what capacity?

Ans. Not in Conn., but in Waterford, Mass., as loom fixer and weaver.

Int. 24. State whether or not you ever operated there a loom in which the leaves of heddles were carried from their extreme point of elevation to their extreme point of depression without any intermediate stop; and state, if yea, what pattern mechanism, if any, said loom had, and how many harnesses.

(Objected to.)

Ans. As far as my recollection goes, I wove upon a loom known as the tappet loom, where there was thirty-six changes in the weave, which was used on eight and twelve harnesses. It was at No. 2 mill, Waterford. There was no mechanism used upon the loom to close the harnesses between the lower and upper extreme points.

Int. 25. How long ago did you first see said loom, and how many did they have at said Waterford, and what was the name of the mill?

(Objected to.)

Ans. About fifteen years ago. I think there was twenty. The mill was known as the No. 2 mill.

Int. 26. During how many consecutive picks of the shuttle in those looms could the same heddle be maintained in its extreme upper position, or in its extreme depressed position?

(Objected to.)

Ans. Thirty-six, I believe.

Int. 27. State how this was done.

(Objected to.)

Ans. It was done by using what we term a tappet, running at such angles as to raise the harness or to lower it, which would retain that position until another was placed in there at a different angle to change it from bottom to top or from top to bottom. These pieces, being thirty-six in number, were held apart by iron rings, through which bolts

430 passed for the purpose of uniting the whole into one pattern or tappet wheel.

Int. 28. Were these tappets removable?

(Objected to.)

Ans. They were. We have changed them while in the loom as well as taking them out and building them up the same as a chain, using for that purpose the same kind of a pattern draft.

Int. 29. How many of these wheels containing removable or adjustable tappets was there to each leaf of heddles?

(Objected to.)

Ans. There was but one wheel to operate the whole. There were

twelve wheels bound together in one. What I call a wheel is a ring of iron upon which is thirty-six pieces of iron representing risers and sinkers.

Int. 30. Now, how many of these wheels were there in each of said looms?

(Objected to.)

Ans. There was one, which we called the pattern or tappet wheel.

Int. 31. Were all the harnesses operated by this one wheel?

(Objected to.)

Ans. They were, each lever working in its respective place formed by these rings of iron.

Int. 32. Did each of these rings of iron have thirty-six removable tappets?

(Objected to.)

Ans. They did.

Int. 33. How many rings of iron were there on each loom?

(Objected to.)

Ans. For a twelve harness there was twelve. For an eight harness there was eight.

Int. 34. Did one ring of iron operate more than one leaf of heddles?

(Objected to.)

Ans. One ring of iron controlled the tappets that worked one leaf of heddles.

Int. 35. You speak of one wheel; of what was that composed?

(Objected to.)

431 Ans. For eight harnesses it was composed of an outside wheel, on each side eight rings, ninety-six tappets, or pieces of iron, and twelve bolts, a shaft with a gear attached, and two outside ears for connecting the gear with the tappet.

Int. 36. Do you know how long said looms had been at Waterford when you went there?

(Objected to.)

Ans. I could not state the time.

Int. 37. Did you find them there when you went there?

(Objected to.)

Ans. I did.

Int. 38. What kind of goods were woven on said looms?

(Objected to.)

Ans. When I was there it was mostly what are called Scotch plaids.

Int. 39. In the practical operation of said looms at Waterford, when a harness that was up at its highest point was to be depressed to its lowest point, and vice versa, and a harness that was at the lowest point of depression was to be elevated to its highest point of elevation, was the passage of the harness from one point to the other either of elevation or depression or vice versa, continuous and without stoppage, or how otherwise?

(Objected to.)

Ans. It was continuous.

Int. 40. In said looms if you were weaving one pattern and desired to change the pattern, what did you do?

(Objected to.)

Ans. We took out the pattern wheel and rebuilt it.

Int. 41. Explain a little more fully what you mean by that.

(Objected to.)

Ans. I mean that we took the pattern or tappet wheel to pieces by

unscrewing the bolts, lifting off the rings of iron, taking down all those pieces which we terme l risers and sinkers, and rebuilding it by fitting them together again as the pattern draught would direct.

Int. 42. If you were using a harness that required to be elevated
432 three picks and desired to have it elevated five picks, what did you do?

(Objected to.)

Ans. Put on two more rises to the three rises, as we would in the Marshall loom, using the same terms.

Int. 43. State whether or not you could weave on said looms at Waterford any variety of fancy goods within the limits of 36 picks to the round and with twelve harnesses.

(Objected to.)

Ans. You could weave any pattern within those limits, if it repeated as many times as any figures you can get in 36—that will divide into 36—for instance 4 times 9, or 3 times 12.

Int. 44. How could you weave these patterns as compared with weaving them on other fancy looms, with 36 bars in the pattern chain, and twelve leaves of harness?

(Objected to.)

Ans. We could not use 35 tappets, leaving out the 36th, without a change of gear, which we could do in other looms by merely leaving out one bar of the chain.

Int. 45. Suppose you didn't leave out a bar of the chain, but used thirty-six bars of chain?

(Objected to.)

Ans. You could not weave a pattern on 36 bars that would have to be wove on 35.

Int. 46. Suppose you were confined to 36 bars of chain, will you then please answer the 44th interrogatory?

(Objected to.)

Ans. I have always seen the same patterns woven within that scope upon the tappet loom as upon the chain loom.

Cross-examination declined.

JAMES SCHOFIELD.

(Counsel for defendants puts in evidence a certified copy of the petition of Moses Marshall for extension of his letters patent, marked Exhibit 13, and a certified copy of the order of hearing and publications thereon marked Exhibit 14.

433 The counsel for complainant objects to the use in evidence of said papers.)

Deposition of Joseph M. Thompson, taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEB. 27, 1867.

Int. 1. State your name, age, residence, and occupation.

Ans. Joseph M. Thompson; 36 years of age; residence, Somerville, Mass.; collector for "Boston Journal."

Int. 2. State in whose employment you were during the year 1863.

Ans. The "Boston Journal."

Int. 3. Please produce the files of the "Boston Journal" for the months of August and September, 1863, and state whether you find any publication therein of the notice of the time of hearing on the application of

Moses Marshall, for an extension of his patent, and annex a copy of said publication to your testimony, and state on what days said publications were made.

Ans. I find in the "Journal" of Aug. 19, '63, bearing date Washington, Aug. 14, '63, issued from the Patent Office at Washington, the petition of Moses Marshall, of Lowell, appearing in the "Journal" Wednesdays, three weeks, commencing Aug. 19, Aug. 26, Sept. 2. I annex a copy.

Int. 4. Was there any other paper bearing the name of the "Journal," published at Boston in 1863?

Ans. No, sir; there was not.

J. M. THOMPSON.

UNITED STATES PATENT OFFICE,
Washington, Aug. 14, 1863.

On the petition of Moses Marshall, of Lowell, Mass., praying for the extension of a patent granted to him the 11th day of December, 1849,
for an improvement in looms for weaving figured fabrics, for
434 seven years from the expiration of said patent, which takes place on the 11th day of December, 1863, it is ordered that the said petition be heard at the Patent Office, on Monday, the 23d day of November next, at 12 o'clock, m.; and all persons are notified to appear and show cause, if any they have, why said petition ought not to be granted. Persons opposing the extension are required to file in the Patent Office their objections specially set forth in writing, at least twenty days before the day of hearing; all testimony filed by either party, to be used at the said hearing, must be taken and transmitted in accordance with the rules of the office, which will be furnished on application.

The testimony in the case will be closed on the 9th day of November next. Depositions and other papers relied upon as testimony must be filed in the office on or before the morning of that day, the arguments, if any, written ten days thereafter.

Ordered, also, that this notice be published in the "Chronicle," Washington, D. C., and the "Journal," Boston, Mass., once a week for three successive weeks, the first of said publications to be at least sixty days previous to the day of hearing.

D. P. HOLLOWAY,
Commissioner of Patents.

Au. 19, w. 3 w.

(Counsel for defendants puts in evidence a certified copy from the Patent Office, marked Exhibit No. 15.

Counsel for complainant objects to the admission of said document in evidence.

Counsel for defendants also puts in evidence a certified copy from the Patent Office, of the file, wrapper, and contents in the matter of the application of Moses Marshall for extension of patent marked Exhibit 16.

Counsel for complainant objects to the admission of said document in evidence.)

Adjourned to 9½ a. m., 28th inst.

435 *Deposition of William Robinson, taken, subscribed, and sworn to before N. Austin Parks, examiner.*

FEB. 28*th.*

(2d in order of time this day.)

Int. 1. State your name, age, occupation, and residence.

Ans. William Robinson; age, 30 years; residence, Worcester, Mass.; occupation, loom fixer.

Int. 2. How long, in all, have you been a loom fixer?

Ans. About twelve years.

Int. 3. Have you had any and what experience as a loom fixer, and for how long on the Crompton close-shed fancy looms and on the Thomas open-shed fancy looms?

Ans. About six years on the Thomas and about two and a half on the Crompton.

Int. 4. About how many Crompton close-shed fancy looms can you take care of and run, as loom fixer, as compared with the number of Thomas open-shed fancy looms?

Ans. About twelve broad Crompton to eighteen broad Thomas.

(Counsel for complainant declines to cross-examine.)

WILLIAM ROBINSON.

Deposition of Francis C. Treadwell, jr., (recalled), taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEB. 28*th*.

(3d in order of time this day.)

Int. 1. Have you previously testified in this case?

Ans. I have.

Int. 2. Please examine the 31st and 32d interrogatories to Horace Wyman in this cause and his answers thereto, as found in the 258th page of the printed record of this cause, and state whether or not the bars hinged, one to the lifter and the other to the depresser, are in any manner or at all described, referred to, or suggested, either in the specification or drawings of the Marshall reissue patent.

436

Ans. They are not in my opinion either described, referred to, or suggested in said Marshall patent. The said bars perform one of the offices of the evener, viz., they prevent the jacks from going in advance of the lifter or depresser by taking hold of the jack to be moved at the same time the lifter and depresser takes hold, compelling the jacks to move with the lifter and depresser; as these bars, however, accompany the jacks all the way through their stroke, they are unlike the evener, which does not control the jacks for a short time in the middle of the stroke. They are also unlike the evener in that they do not hold the jacks at their extreme points of elevation and depression while being shifted. I consider them substantially a different device from the evener, having a substantially different mode of operation, but having one of the effects or capacities of the evener, viz., controlling the jacks in their motion from one extremity of the shed to the other. On looking again carefully at the answer of Mr. Wyman referred to, I find that he does not say that the hinged bar held the jack to the lifter and depresser after it reached the middle of the shed, although the language describing this bar states that it is kept pressed to the jacks by a spring on the back of the bar, which would authorize the assumption that it did accompany the jacks through its whole stroke. It does, however, say that the hinged bar kept the jack from running away from the lifter, in contact with the lifter, till it moved to the centre of the shed, when there was no occasion for its action any longer, and that the same operation was performed by the depresser by similar means. Assuming that the construction was such that the hinged bar only kept the jacks in contact with the lifter until they reached the middle of their movement in making the shed, and that they were then thrown out by some means, then, so far as this hinged bar did control the jacks, and prevent them from going towards the middle of their motion in advance of the lifter and depresser, it performs one of the

offices of the evener, but by a substantially different device and mode of operation.

Int 3. How important an office did said bars perform in said
437 open-shed Crompton fancy loom, constructed according to said testimony of said Wyman?

Ans. Very important. To the best of my judgment, essential to securing any degree of certainty in the operation of that loom.

And in answer to cross-interrogatories propounded by Causten Browne, esq., deponent saith as follows, viz:

Cross-int. 1. Did you ever see a Crompton open-shed loom in operation?

Ans. No.

F. C. TREADWELL, JR.

Deposition of Joseph Clissold, taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEB. 28*th.*

(5th in order of time this day.)

Int. 1. State your name, age, residence, and occupation.

Ans. Joseph Clissold; age, 26; residence, Worcester, Mass.; occupation, manufacturer.

Int. 2. Have you ever had any experience as a practical weaver; if so, how long and to what extent?

Ans. I have had experience for about five years. I've had charge of the shop, and done the designing part of that time; previously to that, I was loom fixer. I learned to weave and run a loom ten years ago.

Int. 3. What knowledge, if any, have you had of the Crompton open-shed fancy loom, and where?

Ans. I had thirty-eight under my care at Dedham, at the Merchants' Woollen Mill, formerly the Maverick Woollen Co.

Int. 4. Was that the mill with which Mr. Thomas Barrows was once connected?

Ans. It is.

438 Int. 5. Please state how said Crompton open-shed fancy looms operated at that mill.

Ans. We had great trouble in running them on fancies with more than eight harnesses. In changing from one pattern to another, there was great delay in getting the loom to run. There was a great amount of breakage on the jacks and leathers, and we never felt sure of getting perfect cloth from them. On fourteen-harness work that we had at one time, it was a common occurrence for three or four jack hooks to break at once. We always tried to favor the open-shed looms in regard to the work that was put into them; that is, we never put in what we called a hard weave on any work with more than eight harnesses, if we could possibly help it. I remember of one warp that it was impossible to work on the open-shed loom, and we cut it out and put it into a close-shed Crompton loom, and we wove it without any trouble. The wear and breakage and delay on the open-shed looms, I should think, was one-third more than on the close-shed.

Int. 6. What character of patterns were woven on said Crompton open-shed fancy looms, with respect to the ease of weaving, and were the patterns frequently changed, or were the same patterns run for a long time?

Ans. During the time that I was there, the majority of the weaving was what we call ladies' cloth. Some of it—a very little—wove on six-harness cotton pattern; the rest was on eight-harness diagonal—both considered easy patterns. The patterns run for a long time, as a general thing. I've known them to be three months without changing the chain on the loom.

Int. 7. How were those looms liked by the hands in the mill?

Ans. The loom-fixers all condemned them, and the weavers that were used to running any other loom did not like to work on them.

Int. 8. How long did your acquaintance continue with those looms?

Ans. Two years, at the same mill.

Int. 9. State whether or not you at any time had any conversation with Mr. George Crompton, and, if so, about what time, in relation to the Crompton open-shed fancy looms, and, if so, state the substance of that conversation, as nearly as you can.

439 Ans. I had, in December, 1865. He asked me in regard to the looms in Dedham. I stated that I did not like them. I asked him if he was building any at the time, and he said no; that he did not like to build them, and should not build any more, unless a customer insisted upon having that kind of loom.

And in answer to cross-interrogatories propounded by J. E. Maynadier, esq., for complainant, deponent saith:

Cross-int. 1. Were you ever in the employ of Mr. George Crompton, of Worcester; and, if so, for how long?

Ans. I was, for about two weeks.

Cross-int. 2. Why did you leave his employ?

Ans. Partly because I did not like the work that was given me to do, and because I had a better job to go to.

And in answer to direct interrogatories resumed, deponent saith as follows:

Int. 10. Did you leave Mr. Crompton of your own accord?

Ans. I did.

JOSEPH CLISSOLD.

Deposition of George Crompton (recalled), taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEB. 28*th*.

(7th in order of time this day.)

Int. 1. Has Moses Marshall, the patentee, whose patent you bought, been present during the progress of the examination in this case?

Ans. A part of the time he has.

Int. 2. Has he been in consultation with you during the progress of the examination in this case?

Ans. He has during the time he was here.

440 Int. 3. Who employed counsel and paid the expenses of getting the extension of the Marshall patent?

Ans. I did.

Int. 4. Who was your counsel in that case?

Ans. Causten Browne, esq.

Int. 5. How much did you pay said Marshall for the assignment of the alleged extended term of his patent?

(Objected to.)

Ans. One thousand dollars.

Int. 6. Did you pay this sum before or after the alleged extension of his patent?

Ans. Being unaware that I should be called on to testify on this point, I have no memoranda by which to refresh my memory, and I do not remember.

Int. 7. How long, or about how long, after the 5th day of May, 1859, the day on which he agreed to assign to you the extension, did you pay him the thousand dollars?

Ans. As I stated before, I do not remember.

Int. 7. State to the best of your recollection the time when you paid him the thousand dollars.

Ans. I have no idea.

Int. 9. Was it as long after as July 1st, 1863?

Ans. I could not tell.

Int. 10. Will you swear positively that you did not pay him said sum of one thousand dollars before the 1st of April, 1863?

Ans. As stated in my previous answers, I have no remembrance when I paid him the one thousand dollars.

Int. 11. Please answer the preceding question.

Ans. I cannot positively swear that I did.

And in answer to cross-interrogatories by J. E. Maynadier, esq., on behalf of complainant, deponent saith as follows, viz:

Cross-int. 1. (De bene.) If you cannot positively state when that payment was made, please state about when, according to your present recollection.

Ans. Upon reflection and a reviewal in my mind of the facts I
441 think it must have been after the extension that I paid him the money.

And in answer to direct interrogatories resumed by J. D. Ball, esq., deponent saith:

Int. 6. Will you swear that the payment of the thousand dollars was made after the extension?

Ans. I will swear I believe it was now.

Int. 7. What induces you to swear so now when you swore in your direct examination that you could not tell?

Ans. I did not have in my mind in the direct examination the fact which has just come into it that I had the refusal of Marshall's patent after it might be extended, and from the nature of that arrangement I believe the money was not paid until after the extension.

Int. 8. Is there anything else that induces this belief?

Ans. I know of nothing more just now.

Int. 9. Haven't you known, ever since May 5th, 1859, the day on which Marshall executed an agreement to you to assign the extended time, that you had such an agreement?

Ans. Certainly.

Int. 10. Do you mean to say that you had forgotten it while you were giving your testimony in this case?

Ans. I had for a moment, while I was inquired of when I paid the money, in endeavoring to remember that fact.

Int. 11. Was not that agreement called for by defendants' counsel twice or more during the taking of the testimony?

Ans. I heard it called for once or twice.

Int. 12. Was it not called for by defendants' counsel and your attention expressly called to it during your previous examination in this case?

Ans. I believe it was.

Int. 13. Was the thousand dollars paid all at one time or at different times?

Ans. All at one time.

GEORGE CROMPTON.

Adjourned to 2.40 p. m.

442 *Deposition of Frank W. Reeves, taken, subscribed, and sworn to before N. Austin Parks, examiner.*

FEB. 28*th.*

(8th in order of time this day.)

Int. 1. State your name, age, residence, and occupation.

Ans. My name is Frank W. Reeves; age, thirty-five years; residence, Guilford, N. H.; occupation, clerk of the Belknap Mills, and book-keeper.

Int. 2. State whether or not since you have been book-keeper of the Belknap Mills, the Manchester Print Works of Manchester, N. H., have purchased any Thomas open-shed fancy looms. If yea, about what time and at what price?

Ans. They purchased one, January 24th, 1865, for $550 and tax.

Int. 3. When did you commence as book-keeper with the Belknap Mills?

Ans. I think it was the 17th July, 1863. It was about that time.

Int. 4. Can you state at about what average price the Thomas open-shed fancy looms, broad and narrow, have been sold since you have been book-keeper at the Belknap Mills?

Ans. I think the broad would average about $400 and the narrow about $300. That would be a fair average, I think.

(Counsel for complainant declines to cross-examine.)

FRANK W. REEVES.

Deposition of Samuel T. Thomas (recalled), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 28*th.*

(9th in order of time this day.)

Int. 1. Have you before testified in this case?

Ans. I have.

443 Int. 2. On what days were you at Worcester to see the operation of the so-called Marshall loom without the evener?

Ans. Last Friday, Saturday, and Monday, I think.

Int. 3. Who was with you at those times?

Ans. Mr. Schofield, Mr. Davis, Mr. Kelly, and Mr. Adams, on Friday, I think. Mr. Edward S. Renwick, on Monday. I have forgotten who was there on Saturday. Mr. Schofield was there on Saturday and on Monday.

Int. 4. Were Messrs. Schofield, Davis, Kelly, Adams, and Renwick the only parties who were there with you, or were there others?

Ans. There was a loom-fixer from Fox's Mill and a girl who attended the loom, and Mr. Crompton's foreman. Wyman was there part of the time.

Int. 5. State who the girl was; whether she was there at your request, or whether she was one of Mr. Crompton's hands?

Ans. Mr. Schofield sent for her to come in. I don't know whether she was Mr. Crompton's girl or one from the Fox Mill.

Int. 6. State where Mr. Renwick was bound at the time he was there on Monday.

Ans. For New York.

Int. 7. Had he or not then finished his testimony in this case?

Ans. He had, as I understood by him.

Int. 8. What instructions, if any, did you give in relation to the operation of that loom?

Ans. I instructed Mr. Davis, Mr. Adams, and Mr. Kelly not to touch the loom, nor alter it in any way, nor run it; but only to see it run by the hands who had run it previously.

Int. 9. Had the girl who was there previously run it for Mr. Crompton?

Ans. I was informed she was the one.

Int. 10. Are the Messrs. Schofield, Davis, Kelly, and Adams persons who have testified in this cause?

Ans. They are.

Int. 11. Why did you get Mr. Schofield?

Ans. Because he was, as I was informed, the man that started it for Mr. Crompton in the first place.

444 Int. 12. What directions did you give Mr. Schofield, if any?

Ans. To run it as though it was his own loom, with the intention to make it run, so as to give it a fair trial.

Int. 13. Were you present by that loom during all the time that Mr. Schofield and Messrs. Kelly, Davis, and Adams were there?

Ans. I was, except a short time when I went out of an errand.

Int. 14. Who did you leave there then?

Ans. Schofield, Adams, Kelly, Davis, the girl who tended it, and the loom-fixer.

Int. 15. Whom did you find there when you got back?

Ans. The same persons.

Int. 16. Was there any change made by you, or any of the persons that you have named in the position of either of the boxes, on that loom, containing the spring-latches; if yea, what change and by whom made, and for what purpose?

Ans. Mr. Schofield drawed my attention to the lower notches on the jacks nearest the lathe which did not go low enough to insure their resting on the spring-catches—and said that end of the spring-box next the lathe should be raised a very little in order to insure the jacks to catch upon them—and asked me what he should do; whether he should raise it or not. I told him to fix it as he thought proper; that they should have a good chance to work. He raised that end of it only about one-sixteenth of an inch, as near as I could judge. Previous to that the jacks failed to catch every time on those catches. After he moved it, it seemed to work better.

Int. 17. Was there any change made, while you were there, in the other box containing the spring-latches?

Ans. No.

Int. 18. Were the boxes, or either of them, containing the latches, or the springs in them, changed in any manner while you were there, except the change which you have already mentioned as made in the position of one of the boxes?

Ans. No.

Int. 19. After the change that you have mentioned did the loom work better or worse than it did before the change?

445 Ans. It worked better. The jacks didn't miss catching on to the notches so often.

Int. 20. How have the prices of the Thomas open-shed fancy looms in 1860 and 1861, and before and since, compared with the prices of the Crompton close-shed fancy looms?

Ans. As far as I know, about the same.

Int. 21. What were the prices of the Thomas open-shed fancy looms in 1860 and 1861?

Ans The narrow looms for woollen work $250, capable of carrying a forty-eight-inch reed, or for cotton fancy looms, capable of carrying a thirty-two-inch reed, $225. The broad looms, as near as I can recollect now, about $300 to $325, as early as that. I recollect now that on Saturday, referred to in my testimony in answer to the 3d interrogatory, there were present Messrs. Kelly, Davis, and Adams.

Int. 22. Have you taken measures to get Messrs. Kelly and Davis here to-day?

Ans. I have, by telegraph.

Int. 23. After Mr. James Tetlow testified in this case, what measures did you take to get them here?

Ans. I telegraphed immediately to them at Lawrence.

Int. 24. What distance is that from Boston, where this testimony is being taken?

Ans. Twenty-six miles.

Int. 25. Was it possible after said Tetlow gave his testimony to get Mr. Adams here to-day before this testimony closes?

Ans. I think not.

Int. 26. Do you know where Mr. Edward S. Renwick is, and has there been any means of getting him here to-day before this testimony closes?

Ans. I suppose him to be in New York. He left here for New York, as he said. It would be impossible to get him here to-day.

And in answer to cross-interrogatories by J. E. Maynadier, esq., in behalf of complainants, deponent saith:

446 Cross-int. 1. You say in answer to the 4th interrogatory that Mr. Wyman, Mr. Crompton's foreman, was there part of the time. How long was Mr. Wyman there?

Ans. He came in to bring a new jack, and stopped but a few moments.

Cross-int. 2. Mr. Dawson testified that the piece marked Exhibit R was woven by a girl on Wednesday of last week. Do you mean to testify that the girl referred to by you in your 4th and 5th answers was that girl?

Ans. I do not.

Cross-int. 3. In your 8th direct answer you speak of hands who had run it previously. Do you mean to testify that those hands run the loom on Friday, Saturday, and Monday?

Ans. Those hands who did run it those days I was informed were those who had run it, or worked on it, previously. I mean Mr. Schofield and the loom fixer, and the girl who came from the Fox Mill. I've no means of knowing that they were the hands who had run it before, except from information.

And in answer to direct interrogatories resumed by J. D. Ball, esq., deponent saith:

Int. 27. When you left the loom on the days you have referred to, in whose charge was it left?

Ans. We left it in no one's charge. We left it in the mill as we found it.

SAMUEL T. THOMAS.

Deposition of James Schofield (recalled), taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEB. 28*th.*

(12th in order of time this day.)

Int. 1. Where did you get the cam rollers which you used on the pattern chain on the so-called Marshall loom at Worcester?

447 Ans. I directed the second hand in the weave-room to get from one to three hundred rollers from Mr. George Crompton's shop within the past six weeks, which he did; and I directed the chain-builder to put upon all those chains which we used upon the Marshall loom those new rollers which I had directed to be got, and which, I've every reason to believe, as far as my own eyes can teach me, he did.

Int. 2. From whom do you get your supplies of cam rollers at your mill?

Ans. Since I've worked at Messenger & Wright's, known as the Fox Mills, we have always got the rollers that we used upon our looms and the Marshall loom from George Crompton's shop.

Int. 3. What Marshall loom do you refer to in your last answer?

Ans. The one at Hamilton's Tape Mill.

Int. 4. How long do you usually use the same cam rollers on the Crompton close-shed loom?

Ans. I never have worked upon a Crompton close-shed loom at one place long enough to see any cam roller wear out when properly oiled.

Int. 5. About how long should you think they might be used on the Crompton close-shed fancy loom?

Ans. Ten or more years, I should think.

Int. 6. When you were called to operate the Marshall loom without the evener, in what condition was it in respect to your being able to run it?

Ans. It was unfit to be run without some alteration.

Int. 7. Did you make any change in the position of either box containing spring latches; and, if so, what change, and why?

Ans. I did; the box upon the back part of the jacks, and the end nearest the lathe. I raised the end nearest the lathe about the sixteenth part of an inch, because the jacks were not brought down by the lifter enough to hook them upon the spring catches.

Int. 8. Do you mean the lifter or depresser in the last answer?

Ans. The lifter I termed that which raises the harnesses and depresses the jacks. I call that the lifter.

448 Int. 9. Was it the inner or outer box containing the spring latches?

Ans. The inner box; the one next the loom.

Int. 10. Did you change the position of the other box at all?

Ans. I did not.

Int. 11. How did you change the position of the one that you did change?

Ans. By unloosing the bolt, and pressing it up one-sixteenth of an inch, or about that.

Int. 12. How did the loom work after you made the change, compared with the way it worked before?

Ans. Better.

Int. 13. After changing the position, did you tighten the bolt?

Ans. I did.

Int. 14. Was there any change made in either of the boxes containing the spring catches, except the one change which you have mentioned as being made in the position of one of the boxes, while you were there?

Ans. There was not.

Int. 15. Were the springs in the boxes altered, or the tension of them or of any of them changed in any way, while you were there?

Ans. They were not.

Int. 16. What directions did Mr. Thomas give you about that loom?

Ans. He directed me to make it run if I could, and I gave particular directions in regard to building the chains, placing thereon new rollers which had never been used on a loom before, for the purpose of obviating every difficulty that would hinder the jacks from catching upon the spring hooks, which I knew to be a grievous fault in the loom. I did everything under Mr. Thomas' directions, as I would have done had George Crompton given me the same.

Int. 17. Did Mr. Wyman call your attention to any eccentricity on any of the cam rollers? If so, which of them, and did you continue to use those that he called your attention to; and, if so, why?

Ans. He did call my attention to some rollers, pointing out only one which I considered was a little out of a true circle, and that one
449 I should not remove were it running upon a twenty-four harness loom. If I had my attention called to other rollers, I did not remove them, and if I signified in any way that the same were an injury to the working of the loom, it is no more than I usually do to any person thinking different from me in regard to its operation, for the reason that they will feel better satisfied in finding out their own mistake by testing the same themselves by an alteration. Were I trying to run the loom myself as a loom-fixer, I should not make any such change. My reasons for not removing a roller so little out of its true circle is because I would not wish to strain at a gnat and swallow a camel; by which I mean that there were greater difficulties to overcome than that, and that was not the true cause.

Int. 18. How would the cam rollers which you have referred to, one of which you said Mr. Wyman called your attention to, have worked on a Crompton close-shed fancy loom?

Ans. They would have worked well.

Int. 19. What sort of a test, as to fairness, did you make of said so-called Marshall loom when running it without the evener?

Ans. Not a fair test to its practical running for the purpose of manufacturing cloth.

Int. 20. Why not?

Ans. Because the first warp which we used was what we term a double and twist warp, and as good a warp as I ever saw put into a loom, and there always being good mechanics, good loom fixers, good weavers to operate the same, which no manufacturer would supply were he using those looms.

Int. 21. Please explain your answer to the 19th direct interrogatory.

Ans. I meant that it would be an expensive loom, and unfit for manufacturing fancy cassimeres, which is expected from a fancy loom.

Int. 22. Was the test which you gave it a harder test than would be given to it when running for practical weaving, or a lighter test, and one under which the loom would be more likely to run well?

Ans. It was a fair test, when run without the evener.

450 Int. 23. Was the test as severe as it would be in running a loom in a manufacturing establishment?

Ans. It was not.

Int. 24. Have you examined the pieces of cloth testified by the complainant's witnesses as having been woven on said so-called Marshall loom without the evener, and if yea, please state the character of that cloth as to ease or difficulty in weaving it, and how it compares in closeness of weaving with the same description of goods, as usually made.

Ans. I have; the piece said to have been woven on Wednesday of last week is composed of good warp, good filling, with not the required number of picks the slay of that warp would require, which causes the cloth to feel what we term slazy. It is a very easy pattern, and no difficulty in making it with such warp and filling.

Int. 25. Please explain your answer to the 4th interrogatory.

Ans. I have fixed looms one year at Almyville, Conn.; for five years at one place—the longest time at any one place—and saw no indications of rollers being worn out in that time. I have seen rollers said to have been among the first iron rollers made, now in use, and in all probability would continue to be used for years. I've never been discharged from any place that I have worked at.

Int. 26. Please state how the piece of cloth produced by complainant's witnesses, as woven partly with and partly without the evener, compares as to ease or difficulty in weaving it, and as to heft, with other descriptions of goods and with the same description of goods.

Ans. It is easy to weave. It is not wove up close enough to satisfy any manufacturer that I have worked for. I could get in many more picks without any breakage of warp or derangement of harness motion.

(Counsel for complainant declines to cross-examine.)

JAMES SCHOFIELD.

451 *Deposition of Robert Davis (recalled), taken, subscribed, and sworn to before N. Austin Parks, examiner.*

FEB. 28*th*.

(13th in order of time this day.)

Int. 1. How long can you ordinarily use the cam rollers, such as you saw used on the so-called Marshall loom at Worcester when run without the evener?

Ans. I do not know how long they can be used. I have used them about three years and never had any occasion to take any off because it was worn, nor seen any rejected where I have worked.

Int. 2. Did you hear the testimony of Mr. Wyman as to the degree of eccentricity on certain cam rollers that were used by Mr. Schofield on the so-called Marshall loom at Worcester when run without the evener? If yea, please state how well they would work on the close-shed Crompton fancy loom.

Ans. I did. They would work well.

Int. 3. While you were present at Worcester did you see any change made in the position of either box on the Marshall loom containing the spring-latches; if yea, on which box, and why was it made?

Ans. I did see a change made on the lower spring-box; it was raised up about one-sixteenth of an inch, the end nearest the lathe was, to let the jacks on to the spring-catches.

Int. 4. How did the loom work after that change was made—better or worse than it did before.

Ans. Better than it did before.

Int. 5. Was there any change made in the other spring-box, either in its position or otherwise, while you were there?

Ans. There was not.

Int. 6. Was there any change made on the springs in the spring-boxes while you were there?

Ans. There was not.

452 Int. 7. Have you examined the pieces of cloth testified in this case as woven one without the evener, and one partly with and partly without the evener? If yea, please state how those pieces of cloth are in respect to ease or difficulty in weaving them and in respect to closeness of fabric.

Ans. It's very easy weaving; there was not picks enough in for that fabric.

(Cross-examination declined by counsel for complainant.)

ROBERT DAVIS.

Deposition of D. H. Kelly (recalled), taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 28*th*.

(14th in order of time this day.)

Int. 1. Please state whether or not while you were present at Worcester there was any change made in the position of either box containing the spring-latches on the so-called Marshall loom. If yea, what change, and why?

Ans. There was a change. The lower box that contained the spring-catches was raised about one-sixteenth of an inch, I should think, to cause the jacks to catch on.

Int. 2. Which end of it?

Ans. The end nearest the lathe.

Int. 3. Was there any change made while you were there in the other box containing spring-latches?

Ans. There was not.

Int. 4. Was there any change made while you were there in the springs, or any of them, or in the tension of any of them?

Ans. There was not.

Int. 5. Have you examined the pieces of cloth testified to in this cause as woven on the so-called Marshall loom at Worcester, one with-
453 out the evener and one partly with and partly without the evener? And if so, please state how those pieces of cloth are in respect to the ease or difficulty of weaving and the closeness of fabric.

Ans. Very easy to weave. It's too light; it's not heavy enough to meet the demands of manufacturers.

(Counsel for complainant declines to cross-examine.)

D. H. KELLY.

454 RESPONDENTS' ADDITIONAL EXHIBITS.

Exhibit No. 13.

The United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the petition of Moses Marshall for the extension of letters patent,

granted December 11th, 1849, improvement in looms for weaving figured fabrics.

In testimony whereof, I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of February, in the year of our Lord one thousand eight hundred and sixty-seven, and of the independence of the United States the ninety-first.

[L. S.] T. C. THEAKER.

To the honorable the Commissioner of Patents:

The petition of Moses Marshall, of Lowell, in the commonwealth of Massachusetts, respectfully represents—

That he is the original and first inventor of certain improvements in fancy looms, for which he obtained letters patent of the United States, dated 11th December, 1849, afterwards reissued 24th April, 1860.

455 That said improvements are of great value to the public, but that he has, without neglect or fault on his part, failed to obtain from the use and sale of his invention a reasonable remuneration for the time, ingenuity, and expense bestowed upon the same, and the introduction thereof into use.

Wherefore, he submits that it is just and proper that his said patent should be, and he prays that it may be, extended for the farther term of seven years, he having paid fifty dollars into the treasury of the United States, and otherwise complied with the acts of Congress in such cases made and provided.

MOSES MARSHALL.

AUGUST 5, 1863.

456 *Exhibit No.* 14.

The United States Patent Office to all to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the order of hearing and publication for the extension of Moses Marshall's patent, granted Dec. 11, 1849. Order dated Aug. 14, 1863.

In testimony whereof, I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of February, in the year of our Lord one thousand eight hundred and sixty-seven, and of the independence of the United States the ninety-first.

[L. S.] T. C. THEAKER.

THE UNITED STATES PATENT OFFICE,
Washington, Aug. 14, 1863.

On the petition of Moses Marshall, of Lowell, Mass., praying for the extension of a patent granted to him the 11th day of December, 1849, for an improvement in looms for weaving figured fabrics, for seven years from the expiration of said patent, which takes place on the 11th day of December, 1863—

It is ordered that the said petition be heard at the Patent Office on Monday, the 23d day of November next, at 12 o'clock m., and all persons are notified to appear and show cause, if any they have, why said petition ought not to be granted.

457 Persons opposing the extension are required to file in the Patent

Office their objections, specially set forth in writing, at least twenty days before the day of hearing. All testimony filed by either party, to be used at the said hearing, must be taken and transmitted in accordance with the rules of this office, which will be furnished on application.

The testimony in the case will be closed on the 9th day of November next. Depositions and other papers, relied upon as testimony, must be filed in the office on or before the morning of that day; the arguments, if any, within ten days thereafter.

Ordered, also, that this notice be published in the "Chronicle," Washington, D. C., and the "Journal," Boston, Mass., once a week for three successive weeks, the first of said publications to be at least sixty days previous to the day of hearing.

D. P. HOLLOWAY,
Commissioner of Patents.

P. S. Editors of the above papers will please copy, and send their bills to the Patent Office, with a paper containing this notice.

458 *Exhibit No.* 15.

The United States Patent Office to all persons whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the files of this office of the file-wrapper and contents in re the letters patent granted M. Marshall Dec. 11th, 1849, No. 6939, and that search has been made, and that no oath or affidavit except the unsigned one in said file-wrapper has been found.

In testimony whereof, I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this eighteenth day of February, in the year of our Lord one thousand eight hundred and sixty-seven, and of the independence of the United States the ninety-first.

T. C. THEAKER.

To the Hon. Thos. Ewbank, Commissioner of Patents:

The petition of Moses Marshall, of Lowell, in the county of Middlesex, and State of Massachusetts, respectfully represents—

That your petitioner has invented certain new and useful improvements in looms for weaving all kinds of twilled, plain, and fancy cloths, an exclusive property in which he is desirous of having secured to him and his legal representatives, by letters patent according to law, he having paid thirty dollars into the treasury of the United States, and complied with all the requisitions of the patent acts in such cases made and provided.

Boston, October 29th, 1849.

MOSES MARSHALL.

459 To Hon. THOS. EWBANK, *Commissioner of Patents:*

SIR: I hereby recognize and appoint Ezra Lincoln, jr., of Boston, my agent and attorney to solicit and receive letters patent for my improved loom; also, for withdrawing my application for the same, should it be found necessary, and in general to do all such things in the premises as he may deem to be for my advantage.

Boston, October 29th, 1849.

MOSES MARSHALL.

To all persons to whom these presents shall come:

Be it known that I, Moses Marshall, of Lowell, in the county of Middlesex, and State of Massachusetts, have invented certain new and useful improvements in looms for weaving all kinds of plain, twilled, and fancy cloths, and that the following description, taken in connection with the accompanying drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvements by which my invention may be distinguished from others of a similar class, together with such parts as I claim and desire to have secured to me by letters patent.

The figures of the accompanying plate of drawings represent my improvements.

Fig. 1, Pl. 1, is a front elevation of my improved loom; Fig. 2, Pl. 2, is an elevation of one end; Fig. 3, Pl. 2, is an elevation of the opposite end, and Fig. 4, Pl. 3, is a vertical section taken at about the centre of the loom just in front of the cam-shaft hereinafter referred to and parallel to the front of the loom.

The loom as represented in the drawings above referred to is completely equipped for use, but it differs from the best cloth looms now in use essentially, only in that portion of the machinery which operates the harness and decussates or shifts the warp. In the common cam loon, as it is called, when it is desired to change the number of sheds in the warp, in order to vary the pattern of the cloth, it becomes necessary to take the loom apart and alter the proportion of the gearing
460 which drives the cam-shaft. This, of course, occasions great delay, and enhances the cost of weaving by this machine. Again, in the "Crompton" loom (so named from the inventor thereof), all the various sheds of the warp are changed every time the filling thread is passed through with the shuttle, which wears the warp extensively and thereby injures the fabric, and indeed renders the loom unsuitable for the weaving of doeskins. In this Crompton loom, also, the arrangement is such that the filling threads always put in where the warp is slack, so that when the lay beats up the filling it does not make so close a fabric as is necessary for satinets, cassimeres, and doeskins.

All these difficulties are successfully obviated by my improvements, and in the loom as I construct it any number of harnesses and different sheds of the warp, from three to twelve or more, may be arranged and held stationary or brought into use according to the pattern of the cloth or the nature of the fabric to be made. The elementary features of my improvements consist in a series of stationery rests which support the jacks of the harness, when sheds operated by them are not in use; the chain-shafts and lifting and depressing bars for operating the jacks and harness; and the evener (as I term it), which is composed of two rollers set in a frame, having a reciprocating rectilinear motion, which rollers press against the bevelled ends of the harness, and assists in shifting the sheds of yarn, and, what is more essential, operate always to keep the levers even for the proper operation of the cams on the pattern chain. The detailed construction of the several parts above referred to and their connected operations are explained in the sequel; but it will be necessary, in order to avoid confusion, to first refer to the main parts of the loom which are old and in common use.

A A A A, in the several drawings, is the main framework of the machine. B B is the driving shaft. C C is the warp bearer from which the warp threads are unwound, and pass over the smaller roller D D, set just above the one just named. E E E E is the lay, with its reed

F F, and the shuttle-box G G, on each side. Over each of said boxes is a picker rod H H-H H, on which the pickers I I slide forward and back, to throw the shuttle. K K-K K are the picker levers or arms which move the pickers, said levers being operated from the cam-
461 shaft L L, through the medium of the connecting rods M M, and vertical arms N N, extending up from the cross-shafts O O O O. These cross-shafts are rocked so as to move the picker arms by means of their bearing plates P P, on which the cams on the shaft L L operate in a manner which is well understod by those engaged in weaving. Q Q, Fig. 1, Pl. 1, is the cloth beam on which the fabric is wound after it is woven. R R is the shaft which drives the lay by means of the crank rods S S, Figs. 2 and 3, Pl. 2. This shaft also operates the apparatus, hereinabove referred to, for springing the harness, which apparatus I shall now proceed to explain.

a a-a a, in the several figures, is the framework which supports the main portion of the harness or heddle apparatus. b b-b b, &c., are the upper harness levers which are connected to heddles of any number of warps by means of the cords c c-c c and double spring plates d d, &c., arranged as shown in Fig. 1, Pl. 1, and Fig. 4, Pl. 3, at one end of said levers. These levers have a fulcrum, and turn on the short cross-shaft e e, which has suitable bearings in vertical uprights f f Fig. 1, Pl. 1, and Fig. 4, Pl. 3, which are fastened to the framework a a a, &c. The outer ends of these levers b b are connected to the several jacks g g g-g g g by a pivot point, as shown in the figures last referred to. These jacks are all of them forked at their lower ends, as shown in the front elevation and sectional view, Fig. 4, Pl. 3, of the loom, and have near the bottom of each prong of their forks g g an interior and exterior step or shoulder, as shown, respectively, at h h, &c., and i i, &c. The interior steps are operated upon by the elevating and depressing bars k k and l l, which extend between the two endless chains m m-m m, operated by the toothed and plain wheels n n-n n on the opposite ends of the two shafts o o-o o, having proper bearings in the framwork a a a, by the revolutions of which shafts the said elevating and depressing bars are operated and move the jacks and harness levers in a manner which will be well understood. The exterior steps or shoulders i i of the jacks g g g, &c., are for sustaining such heddles or harness as are not in use for the formation of the particular fabric which is in process of weaving on the loom, but which are wanted in other kinds of cloth which it is desirable to weave in the same loom. These exterior shoulders
462 drop, or are sustained on the series of rests p p p-q q q, set in hollow boxes r r-s s, arranged on each side of the jacks and attached to the framework a a a, as shown in the several drawings. Each of these rests has a small tongue t-u, cast on the upper side of those denoted at p p, &c., and on the under side of those represented at q q q, which fits between one side of the box r r, or s s, and the long plate v w, extending one across each of said boxes, and attached to a turning rod y-z having a spiral spring so wound round it as to press said rest outward. The outer ends of these rests are bevelled or chamfered off a little, as shown in Fig. 1, Pl. 1, and Fig. 4, Pl. 3, so as to correspond with or be worked by a similar bevelled face, formed on the exterior shoulders of the jacks, as shown in the figures before referred to. When the jacks are kept in operation by the cams on the pattern chain (hereinafter referred to), these rests will be pressed back, and allow the jacks to pass without obstruction, by the arrangement of bevelled faces on said jacks and rests, as above described; but where the jacks are not pressed upon by the cams on the pattern chain, they will be supported on said rests,

as hereinbefore suggested. The lower outer ends of the jacks are connected by the metallic wires a^1 a^1-a^1 a^1 to the ends of the lower set of heddle levers b^1 b^1-b^1 b^1, which have their fulcrum and turn on the short shaft c^1 c^1, Fig. 2, Pl. 2, in a manner which is well understood. These wires are stretched in a diagonal direction so as to draw the shoulders of the jacks (when they are not pressed by the cams) over and upon the rest above referred to.

The shafts o o-o o, which carry the elevating and depressing bars k k-l l, and move the jacks, are revolved by means of a bevel gear-wheel d^1, on one end of the upper shaft o o, which, by means of the bevel gears e^1-f^1-g^1 (arranged as clearly shown in Figs. 2 and 3, Pl. 2), connects with a system of eccentric gear-wheels h^1 i^1 k^1, the former two of which have bearings in proper boxes attached to the framework a a a, &c., and the latter of which is arranged on one end of the long shaft R R, which derives its motion through the medium of the spur gear-wheels m^1 n^1, from the cam-shaft L L, hereinbefore referred to. The use of these eccentric gears, as will readily be perceived, give a varying motion to the heddles, and are so arranged, as in "shedding" the warp, to move it most rapidly just when it is shifted, or the two threads
463 of the warps pass the plane of decussation, in order to catch the filling before the lay, which has beat it up, leaves it, thereby making a much closer fabric than is ordinarily produced.

The pattern chain, as it is termed, is composed of the two endless chains o^1 o^1-o^1 o^1, between which are stretched the cross-rods p^1 p-$^1p^1$, on which the circular cams or rollers, q^1 q^1 q^1, which may be moved along on said rods so as to vary the pattern by operating on different jacks against which they press. This pattern chain, with its rollers and rods, is hung over, and turned with, the shaft r^1 r^1, Fig. 2, Pl. 2, which shaft is revolved by means of a ratchet-wheel s^1, on one end of said shaft, operated by the catch t^1, said catch being moved by a crank rod u^1 u^1, shown by dotted lines in Fig. 4, Pl. 3. One end of this crank works in a slot of one arm of the right-angular lever v^1 v^1, to the other arm of which the catch t^1 is connected, as shown by dotted lines in said Fig. 4. The other end of the crank rod is connected eccentrically to the face of the gear-wheel w^1, which is revolved by the gear-wheel e^1, on the upper shaft o o, which drives the jacks as hereinabove explained. The motions of the pattern chain are regulated by the notched wheel y^1 (on the front end of the shaft r^1 r^1), and spring pall z^1, arranged as shown already in Fig. 1, Pl. 1.

It now only remains for me to describe the "evener," as I have hereinbefore termed it, which works with the heddle or harness lever, so as to assist in shifting the sheds, and to keep said levers in accurate position for the operation of the cams.

This evener consists of two rollers a^2 a^2-b^2 b^2, which are set and have bearings in the forked ends c^2-d^2, of two horizontal bars e^2 e^2-e^2 e^2; said bars being arranged so as to move forward and back in proper guides or holes formed in the upright and curved supports f^2 g^2, attached to the top of the framework a a a. These rollers press against the outer bevelled ends of the upper harness lever b b-b b, shaped as shown in Fig. 1, Pl. 1, and Fig. 4, Pl. 3, and, as will be palpable, serve in the purposes hereinabove suggested. A reciprocating rectilinear motion is imparted to this "evener" by means of the crank arms h^2 h^2, on oppo-
464 site ends of the shaft i^2 i^2 (having proper bearings depending from the framework a a a), said crank arms being attached to one end of the connecting rods k^2 k^2, the other ends of which rods are connected to the sliding bars e^2 e^2-e^2 e^2, as shown in Fig. 1, Pl. 1. The shaft i^2 i^2 is

vibrated or rocked so as to give the requisite motion to the "evener" through the medium of the several parts arranged or connected as above described, by means of the crank arm l^2 and connecting rod, m^2 m^3, the lower end of which is attached eccentrically to the middle wheel i of the eccentric gears hereinbefore referred to, in the machinery for driving the jacks.

Having thus described my improved loom, I shall state my claims as follows:

What I claim as my invention, and desire to have secured to me by letters patent, is the improvement hereinabove described in the machinery for operating the harness, so that any proper number of heddles may be used or changed, as desired, without taking the loom to pieces; said improvement consisting, first, in providing the movable spring rests for supporting the jacks of the harness when they are not in use, and which are sprung back by the bevel face on the shoulders of the jacks, where they are kept in play by the cams on the pattern chain, the whole arrangement being substantially as hereinabove set forth; and, second, in the "evener," constructed and operating as herein described, for assisting in moving the upper heddle levers and keeping them even, so that the cams or rollers on the pattern chain will operate accurately on the jacks, as specified, meaning to claim the exclusive use of said spring rests and "evener" in a loom, the invention of which is entirely original with me.

I also claim the combination of rotating, lifting, and depressing bars, arranged in endless chains, so as to revolve, as described, with the forked jacks, having internal shoulders, as specified.

In testimony that the foregoing is a true description of my said invention and improvements, I have hereunto set my signature this twenty-ninth day of October, A. D. 1849.

MOSES MARSHALL.

Witnesses:
EZRA LINCOLN, Jr.
HENRY G. CLARK.

465 STATE OF MASSACHUSETTS, *County of Suffolk, ss:*

Boston, October 29th, A. D. 1849, personally appeared before me the above-named Moses Marshall, and made oath that he verily believes himself to be the first and original inventor of the improvements hereinabove specified and described; that he does not know or believe the same were ever before known or used, and that he is a citizen of the United States of America.

_____ _____,
Justice of the Peace.

No. 4874. DEC. 31, 1849.

In conformity to an act of Congress, entitled "An act to promote the progress of useful arts," approved 4th of July, 1836, I have received of Moses Marshall, Middlesex County, Mass., thirty dollars, which sum has been placed to the credit of my account with the assistant treasurer, Boston, under the date of Oct. 30, 1849, and for which I have signed a receipt for a patent loom for weaving fancy cloths.

W. JULEN,
Treasurer of the United States.
ALLEN A. HALL,
Register of the Treasury.

Registered, J. C. H.

No. 6939.—*Moses Marshall, of Lowell, County of Middlesex, State of Mass.*

Loom received Nov. 5th, 1849.
Petition, " " "
Affidavit, " " "
Specification, " " "
Drawing dup., " " "
Model 7, " " "
1 cert. dep. $30, " " "
466 Cash,
2 examined Fitzgerald, Nov. 27th, 1849.
3 issue, DeWitt C. Lawrence, " "
Patented Dec. 11, 1849.
Recorded vol. 40, page 485.

E. LINCOLN, JR.,
Boston, Mass.

467 ADDITIONAL TESTIMONY FOR COMPLAINANT.

Deposition of James Crompton, taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEB. 26*th*.

Int. 1. State your name, age, residence, and occupation.

Ans. James Crompton; age, 63 years; residence, Windsor Locks, Conn.; I work in the counting-room.

Int. 2. Are you related in family to Mr. George Crompton, the complainant in this case?

Ans. I am his uncle.

Int. 3. What has been your occupation previously to your present employment, particularly as regards the art of weaving and designing for weaving?

Ans. Nothing but weaving and spinning. I've been in the manufacturing business all my life. I've had charge of both spinning and weaving departments.

Int. 4. Have you had any and what experience in the designing of patterns for fancy weaving?

Ans. It was my business for some twenty years, steady.

Int. 5. Are you practically acquainted with the use of cam looms like that represented by Model No. 5?

(Objected to.)

Ans. No; I never had much to do particularly with cam looms, but with weaving in general.

Int. 6. Do you know what the kinds or styles of pattern are
468 which can be woven on a loom like No. 5, using only cam sections of the same size and form as those which are now represented in No. 5?

Ans. Light-leaved twills and broken twills.

Int. 7. Will you name some of the kinds or styles of pattern which cannot be woven on a loom like No. 5, using only cam sections of the same size and form as those which are now represented in No. 5?

Ans. Such as three-leaved twills, five-shaft satteens, five-shaft doeskins, nor plain nor cotton cloth, nor corduroys, on those cams, nor velveteens.

Int. 8. Generally speaking, will the loom weave any kind of goods

known as fancy kerseymeres, using only cam sections of the same size and form as those which are now represented in No. 5?

Ans. No; only those that I have mentioned.

Int. 9. Are those goods which you have mentioned goods which are known as fancy kerseymeres?

Ans. No, sir.

Int. 10. In what proportion are the kinds or styles of goods which can be woven on a loom like No. 5, using only cam sections of the same size and form as those which are now represented in No. 5, to those kinds or styles which cannot be so woven, having regard to the ordinary demand of the woollen goods market.

Ans. I should think there would be very few called for.

Int. 11. You have mentioned in your answer to the 6th interrogatory certain descriptions of goods, viz., eight-leaved twills and broken twills. What proportion do these goods make of all the kinds of figured woollen goods which the market ordinarily requires?

Ans. I should think very small indeed.

Int. 12. You stated that you never had much to do particularly with cam looms. Now state, if you please, what have been your means of knowing what kinds or styles of patterns could be woven on such looms.

Ans. My experience was first in hand-loom weaving; then power-loom weaving with tappets in the Crompton loom. It's not very extensive in cam weaving. I've had cam looms to weave ginghams, &c.,
469 and I've seen cam looms to weave as far as six or eight to the round.

And in answer to cross-interrogatories propounded by J. D. Ball, esq., deponent saith as follows:

Cross-int. 1. Please examine Model A, and state what kinds of pattern the pattern mechanism in that model, as it now is, is set for.

(Objected to.)

Ans. For four-leaved twill.

Cross-int. 2. Take Model A, as it now is, with the number of bars (eight) in the pattern chain which it now has, and the number of heddles it now has (four), and state the names of the different varieties of goods which it can be set for, without any addition to the number of bars in the pattern mechanism or number of heddles.

(Objected to.)

Ans. If you had more or less rolls, you could vary the pattern.

Cross-int. 3. Please answer the preceding question, supposing no more cam rollers are added, but supposing that you may change them to any extent that they are capable of being changed on the eight bars.

(Objected to.)

Ans. You could weave a plain and cotton cloth with those same bars, and same number of rolls on, and I could weave two picks in a shade with the same number of bars.

Cross-int. 4. Do you call the goods that you have mentioned in your last answer fancy goods?

Ans. No, sir.

Cross-int. 5. Without changing the number of bars in loom Model A, or the number of heddles, can you weave three-leaved twills in that loom?

(Objected to.)

Ans. No.

Cross-int. 6. Can you weave five-shaft satteens?

(Objected to.)

470 Ans. No.

Cross-int. 7. Can you weave five-shaft doeskins?

(Objected to.)

Ans. No.

Cross-int. 8. Can you weave corduroys or velveteens?

(Objected to.)

Ans. No, sir.

Cross-int. 9. Can you weave eight-leave twills?

(Objected to.)

Ans. No.

Cross-int. 10. Can you weave broken twills

(Objected to.)

Ans. No; I could set it to weave different things.

Cross-int. 11. My question is whether you could weave on that loom broken twills, the pattern mechanism having but eight bars and no more, and the loom four heddles and no more, as Model A now has, varying the number of rolls, as you please, within the limits of the eight bars and four heddles.

(Objected to.)

Ans. Yes. I could weave two or three different kinds of cloth that way. I could weave a four-leaved satteen that way.

Cross-int. 12. Can you weave corduroys?

(Objected to.)

Ans. By adding another bolt I could.

Cross-int. 13. Could you without adding another bar to the pattern chain?

(Objected to.)

Ans. No.

Cross-int. 14. Can you weave a three-leaved twill on Model A, with its eight bars on the pattern chain and its four heddles, varying the cam rollers on said eight bars as you please?

(Objected to.)

Ans. No.

Cross-int. 15. Now answer the preceding question as to five-shaft satteens.

(Objected to.)

471 Ans. Not without altering it to five bolts and five harnesses.

Cross-int. 16. Now answer the same question as to five-shaft doeskins.

(Objected to.)

Ans. No, sir.

Cross-int. 17. Please state whether or not you consider Model A, as it now is, to represent a fancy loom.

(Objected to.)

Ans. Do you mean the mechanism of it? Yes, I think the mechanism of it does, but the chain—the bars on the rolls is put together for plain cloth, cotton or woollen.

Cross-int. 18. Do you consider Model A, as it is now arranged, represents a fancy loom? Please answer yes or no, if you can.

(Objected to.)

Ans. I should think the mechanism part of it does.

And in answer to direct interrogatories resumed by Causten Browne, esq., deponent saith as follows:

Int. 13. (De bene.) Supposing a loom like Model A to have eight hed-

dles instead of four, and eight bars of chain as it now has, and supposing that you change the number and arrangement of rolls as you please, but always use rolls and spindles of the same form and size as those now represented in the model, what varieties of fancy goods can you weave on such a loom?

Ans. You would weave different kinds as far as the extent of the eight bars went.

JAMES CROMPTON.

Deposition of James Tetlow, taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEB. 28*th.*

(1st in order of time this day.)

Int. 1. State your name, age, residence, occupation.

Ans. James Tetlow; 42 years of age; Worcester, Mass.; machinist.

472 Int. 2. Are you in the employment of Mr. Crompton, the complainant?

Ans. Yes, sir.

Int. 3. Were you present in Hamilton Mills on the 11th of this month, Monday before last, when the Marshall loom, or open-shed loom standing there, was started up and worked?

Ans. Yes, sir.

Int. 4. Were Mr. Crompton or Mr. Wyman present?

Ans. Yes, sir.

Int. Were there any other persons present, and if you heard them called by name, state how?

Ans. There were other persons present, but I did not hear them called by name. Mr. Treadwell was one.

Int. 6. Did you after the loom was started see it suddenly stop?

Ans. Yes, sir.

Int. 7. What did you do then?

Ans. I suspected the cause of it, and replaced the part which got detached.

Int. 8. What part was that?

Ans. The extension block, and the block on the bottom shaft.

Int. 9. Was there a roller on that which struck the wing on the picker shaft?

Ans. Yes, sir.

Int. 10. What did you replace this with?

Ans. A wrench.

Int. 11. Did you go and get it for the purpose?

Ans. Yes, sir.

Int. 12. Did these gentlemen whom you saw at Worcester on the 11th February come up again, or some of them, the latter part of last week, and take the loom in charge and operate it?

Ans. Yes, sir.

Int. 13. Was there at that time some woven cloth standing in the loom; if so, about how much?

Ans. There was. From four to six yards.

Int. 14. State, if you know, who wove that piece.

Ans. I wove the principal part of it.

473 Int. 15. By whose direction?

Ans. Mr. Wyman's.

Int. 16. How were those goods woven, with the evener, or without the evener, or some with and some without?

Ans. Some with and some without.

Int. 17. Are you a woollen weaver?

Ans. No, sir.

Int. 18. What is your own judgment of the operation of weaving by yourself on that loom and the operation of weaving upon it by an experienced woollen weaver as showing what the loom will do? Which of the two would, in your own opinion, give the best test?

(Objected to.)

Ans. An experienced woollen weaver.

Int. 19. Was the Marshall loom again started up by Mr. Wyman, or under his direction, yesterday afternoon?

Ans. Yes, sir.

Int. 20. Were you present, and what was your business there?

Ans. I was present; my business was to act as machinist.

Int. 21. Who else was present, if anybody?

Ans. Charles Dawson.

Int. 22. In putting in your warp, how did you find the selvage of the last warp which the loom had woven?

(Objected to.)

Ans. Found the selvages with about 20 inches of the same cut off.

Int. 23. Do you know whether this is a usual or unusual proceeding when a warp is taken out of a loom?

(Objected to.)

Ans. It is unusual when a warp is taken out when the cloth is attached to it.

Int. 24. What is the effect of starting to weave cloth with the selvage in such a condition?

(Objected to.)

Ans. It makes it difficult to weave it perfect, for the first yard

Int. 25. What did you observe, first, after Mr. Wyman started up the loom yesterday afternoon?

(Objected to.)

474 Ans. I observed that there was one picker on the picking-staff worn out, which would interfere with the proper working of the shuttle.

Int. 26. Did the loom miss picks when first started?

Ans. Yes, sir.

Int. 27. Did Mr. Wyman do anything to the loom then, and what was it?

Ans. He did. He altered the cylinder shaft, more generally termed chain cylinder.

Int. 28. What did he do with that?

Ans. He altered its position and time.

Int. 29. How did he alter the position of the chain-cylinder shaft? Which way did he move it?

Ans. Towards the centre of the loom.

Int. 30. Did it bear more or less on the jacks, then?

Ans. It bore more.

Int. 31. You said he changed the time also; the time of what?

Ans. The cylinder.

Int. 32. What did he do in making that change?

Ans. He either put it later or forwarder, I couldn't state which.

Int. 33. Put what later or forwarder, on what?

Ans. Put the cylinder rolls on the jacks.

Int. 34. Before these changes were made, did the loom miss picks?

Ans. Yes, it did.

Int. 35. In addition to the changes you have mentioned, was anything done about the spring latches or the box supporting them?

Ans. Yes, sir.

Int. 36. What was that?

Ans. The tension of the spring was altered; the box had to be readjusted.

Int. 37. Do you know whether the box was in the same position that it was in when you last saw it?

Ans. It wasn't in the same position.

Int. 38. When had you last seen it—before or after the second operation with the loom of the gentlemen unknown to you whom you mentioned above?

475 Ans. Before.

Int. 39. How do you know it was not in the same position that it was in before?

Ans. I made corresponding chisel marks on the frames and boxes to which it is attached.

Int. 40. When did you make these chisel marks?

Ans. On the afternoon of the first day the gentleman unknown to me first came.

Int. 41. After all these changes had been made in the loom, how did it work?

Ans. It worked all right.

Int. 42. How many goods were woven from that time, and how many before that time?

Ans. About four yards after, and two before.

Int. 43. How were these four yards woven—with the evener, or without, or partly with and partly without?

Ans. Partly with and partly without.

Int. 44. Who did the weaving on this occasion?

Ans. Mr. Dawson.

Int. 45. After the changes you have mentioned were made were there any imperfections in the cloth woven, and if there were will you state when and how they occurred?

(Objected to.)

Ans. I didn't see any imperfection in the cloth woven, as far as I could judge.

Int, 46. Is there here present a piece of cloth containing any of the yards of the work which you have testified to as (1) being left by you in the loom before the gentlemen unknown to you took charge of the loom the second time, and (2) the work woven by them and left in the loom or found there after their departure, or (3) the work woven by Mr. Dawson yesterday afternoon?

Ans. There is all three parts.

(The piece of cloth referred to is here produced and put in evidence, marked Complainant's Exhibit R.)

476 Int. 47. Will you describe the limits of these three pieces of work on the piece of goods produced, so that we can identify them and tell which is which?

Ans. The first work mentioned is purple and beginning at the end of the piece extends to the line of the red tape, about six yards. The next work mentioned extends from the line of the said piece of red tape to the line of the white piece of tape, about two yards. The third work

mentioned extends from the line of the said piece of white tape to the end of the entire piece, through the parti-colors.

Int. 48. Is there a mark, in this last-named extent of work, where imperfections ceased to occur yesterday afternoon, as above stated by you?

Ans. Yes, sir.

And in answer to cross-interrogatories by J. D. Ball, esq., deponent saith as follows, viz.:

Cross-int. 1. How long have you been in the employ of Mr. Crompton, the complainant?

Ans. Not quite two years.

Cross-int. 2. Was Mr. Wyman, whom you have referred to in your testimony, present on the 11th of the present month at the time that you repaired the Marshall loom, so called?

(Objected to because it has not been testified by the witness that the loom was "repaired," properly speaking.)

Ans. Yes, sir; when I commenced to repair it.

Cross-int. 3. Was he not there all the time that you were there repairing that loom on that day?

Ans. Not all the time.

Cross-int. 4. What repairs did you do on that loom on that day when he was not present?

Ans. I put on the extension block and the picking roll attached to it.

Cross-int. 5. Why did you put those on?

Ans. The loom stopped suddenly; I suspected the cause of it and went to put it right.

477 Cross-int. 6. Was that the only thing that you did to it on that day?

Ans. To the best of my knowledge, after they came.

Cross-int. 7. Do you mean to swear that Mr. Wyman was not present at the time you did this?

Ans. Whilst I was putting it on he went out to fetch a piece of cloth from the adjoining mill. It was on when he came back.

Cross-int. 8. Do you mean to swear that while you were making these repairs on that loom that you noticed that Mr. Wyman was out of the room?

Ans. Mr. Wyman was in the room at the time the loom stopped; the next time I saw him he came into the room with a piece of cloth in his hand.

Cross-int. 9. Where were you when the loom stopped?

Ans. I was one side of the room talking with the engineer.

Cross-int. 10. Where was Wyman at that time?

Ans. Standing pretty near the loom.

Cross-int. 11. What did Mr. Wyman do when the loom stopped?

Ans. He started to go up in the upper room and I met him, and asked him if I should put the picker rolls and block on again?

Cross-int. 12. Did the conversation occur in the same room where the loom was?

Ans. Yes.

Cross-int. 13. Did said Wyman make an examination of the loom after you had thus repaired it?

Ans. No; not that I saw.

Cross-int. 14. You say in your 37th answer that the box was not in the same position as it was when you last saw it. Please explain what you mean by that.

Ans. There are two boxes on a loom; each contains 16 latches, which

are operated on by the jacks; these boxes are bolted on to the cast-iron frame. I made corresponding chisel marks on the frame and the boxes, which were not in the same position when I last saw it.

Cross-int. 15. What was the difference in position?

Ans. One had been moved lower. To the best of my knowledge the other higher; but one positively lower.

478 Cross-int. 16. Which is the one you are positive about?

Ans. The outside one.

Cross-int. 17. Will you swear positively that the position of the other had been changed?

Ans. Yes

Cross-int. 18. How changed? I speak now of the inner one.

Ans. I can't be positive which way it was changed; but I am positive it was changed.

Cross-int. 19. In the outside one, how much had it been changed?

Ans. I couldn't swear positively, but one side had been changed more than the other.

Cross-int. 20. State, as nearly as you can, how much the position of each of said boxes had been changed.

Ans. Well, one I might term a strong eighth of an inch, and the other a strong sixteenth.

Cross-int. 21. Did you make any measurement?

Ans. Only with the eye.

Cross-int. 22. Who was present when you made the chisel marks?

Ans. I couldn't swear to any one being present.

Cross-int. 23. Who do you think was present?

Ans. I couldn't say. I did it voluntarily.

Cross-int. 24. How did you come to do it voluntarily?

Ans. The loom was working well and I thought I would make the marks as a guidance.

Cross-int. 25. On what day did you make those marks, and what time of the day?

Ans. It was the day that the first six yards were wove. The day that you people came over. It was in the early part of the forenoon.

Cross-int. 26. You state that the tension of the spring was altered. In what respect—increased or diminished?

Ans. If my memory serves me right it was increased.

Cross-int. 27. Which spring do you refer to?

Ans. The spring that works the latches in the box.

Cross-int. 28. More than one spring?

Ans. It was the spring attached to the outside box that works the latches.

479 Cross-int. 29. Was the spring that works the other latches changed in its tension?

Ans. I didn't notice its being so.

Cross-int. 30. How many springs were there as to each box of latches?

Ans. One spring.

Cross-int. 31. Do you know whether the tension was increased or decreased on this spring?

Ans. The tension of the spring on the latches was increased.

Cross-int. 32. For what purpose was that done?

Ans. I can't tell; that was done when I saw the loom.

Cross-int. 33. Have you not already sworn that one of the changes that was made yesterday afternoon was to alter the tension of the spring?

Ans. Yes.

Cross-int. 34. Now, do you know for what purpose the tension was altered?

Ans. It was to bring it back again in the position it was when I left it.

JAMES TETLOW.

Deposition of E. D. Thayer, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 28*th.*

(4th in order of time this day.)

Int. 1. What is your name, age, residence, and occupation?

Ans. E. D. Thayer; residence, Worcester; age, 44; occupation, manufacturer.

Int. 2. Were you ever employed by the Washington Mills at Lawrence, Mass.; and if so, when first, and for how long?

Ans. I was there about six years. I went there in 1859 and left in 1865?

Int. 3. During that time were any Thomas open-shed fancy looms used in that mill; if so, about how many in all, and about what time were they put in?

480 Ans. We had more or less Thomas looms there all the time. When I left I think they had over a hundred.

Int. 4. State how they did their work.

Ans. We had some good work, some indifferent, and some poor work from them.

Int. 5. Were any changes made in these looms from time to time; if so, for what purpose?

Ans. The looms would get out of order and have to be fixed, like all other looms. Some improvements were made from time to time to obviate some difficulties which were in the looms.

Int. 6. After these improvements were put upon those looms, how did they work, both on heavy goods and light goods?

Ans. They worked, I think, better on the light fabrics than on the heavy ones. I think they did very good work on the light fabrics, generally speaking.

Int. 7. What were the difficulties of those looms?

Ans. They were troubled more or less with what we call the "mispick."

Cross-examination declined by J. D. Ball, esq., for respondents.

E. D. THAYER.

Deposition of Charles Dawson, taken, subscribed, and sworn to before N. Austin Parks, examiner.

FEB. 28*th.*

(6th in order of time this day.)

Int. 1. State your name, age, residence, and occupation.

Ans. Charles Dawson; age, 37; residence, Worcester; occupation, manufacturer.

Int. 2. Have you ever seen the Marshall loom at Worcester in operation; and, if so, when did you first see it, and where?

Ans. Last week Wednesday, at Mr. Hamilton's mill at Worcester.

481 Int. 3. When you saw it, about how much cloth had been woven on it, and by whom?

Ans. I should think about sixteen or seventeen yards; by whom I don't know; a woman was there at work on it whose name I don't know.

Int. 4. How came you to see that loom at that time?

Ans. Curiosity.

Int. 5. How were those fifteen or seventeen yards spoken of woven; what was the quality of the work?

Ans. Somewhat imperfect.

Int. 6. Did you see any more weaving done upon that loom at that time; if so, about how much, and about how long did it take?

Ans. I did. I should say from three to four hours, and about eleven or twelve yards.

Int. 7. What was done to the loom, if anything, before these eleven or welve yards were woven, and by whom?

Ans. I do not know what was done to it. Mr. Wyman made some little adjustment; in what particular I couldn't say.

Int. 8. Did you examine the cloth woven after the adjustment was made; and, if so, state what the quality of the work was.

Ans. I did; and should think it was very good.

Int. 9. State whether or not there was an evener upon this loom when that cloth was woven.

Ans. There was not.

Int. 10. How do you know that there was not?

Ans. Because I did not see any connections to the harness jacks aside from the lifter and depresser.

Int. 11. Did you afterwards see the evener put on that loom; if so, how soon after the cloth was woven?

Ans. I did. After the cloth was woven Mr. Wyman came in with the evener, and put it on the loom.

Int. 12. Please produce the cut of cloth woven at that time as an exhibit in this case, and state how you identify it.

Ans. This is the piece—marked "Exhibit S," N. A. P., Ex'r. I know it by the peculiarity of the filling wove into the heading end—I
482 mean the first part of the cloth that was woven. I also know it by the number and by the general appearance and the texture of the goods and the manner in which it is woven.

Int. 13. Since that time have you seen any other work on that loom; if so, when, where, and who was present?

Ans. I have, yesterday. Mr. Wyman and Mr. Tetlow were present a part of the time.

Ans. 14. Did you yourself weave cloth on that loom yesterday; if so, was the evener on the loom or not when the cloth was woven?

Ans. I did. The evener was on part of the time and part of the time off.

Int. 15. Point out, if you please, the cloth that you wove yesterday on the Marshall loom?

Ans. There is about six yards or a little more. About two yards of it is slightly imperfect. (The witness refers to Exhibit R, N. A. P., Ex'r, the parti-colored end.)

Int. 16. State how much of the piece produced you wove. And what was the quality of the work?

Ans. About six yards. Two yards of it slightly imperfect. Four yards perfect, one yard being wove without the evener, and one with, alternately.

Int. 17. In what part of the cloth are the two imperfect yards?

Ans. In the first part of the six which I wove.

Int. 18. What caused these imperfections, and what was done to prevent them occurring in the other four yards?

Ans. I suppose some disarrangement of the harness motion caused them. I do not particularly know what was done.

Int. 19. How were those two imperfect yards woven; with the evener or without?

Ans. Mostly without.

Int. 20. What were the imperfections in those two yards; on which side of the cloth?

Ans. They were mispicks on the back side of the cloth.

Int. 21. Are there not some mispicks in the last two yards of Exhibit R; if so, how many, and how were they caused?

Ans. I don't know of any mispicks or imperfections in the cloth.

483 Int. 22. What caused the difference in shades of the same color in the piece of cloth?

Ans. Some of it is caused by variation in the filling, some is caused owing to the bobbins which the filling was on being large at the top, so that when the filling came to be nearly off the bobbin towards the bottom it caused it to draw much tighter. Some little of it was caused by the filling on some of the bobbins being wet.

Int. 23. Are the two Exhibits R and S in the same stage of manufacture; and if not what is the difference?

Ans. They are not in the same stage of manufacture. The piece R is not scoured, or full, or raised, in any part of it. That is the principal difference between them. Exhibit S has been scoured.

Int. 24. In weaving the last four yards of Exhibit R, how many mispicks in all did the loom make?

Ans. Two is all that I know of.

Int. 25. Why do they not appear now in the cloth?

Ans. Because I picked them out.

Int. 26. Were any other mispicks in those four yards picked out except those two?

Ans. I know of none.

And in answer to cross-interrogatories by J. D. Ball, esq., deponent saith as follows, viz:

Cross-int. 1. Where did you last see the woman referred to in your answer to the 3d interrogatory?

Ans. I never saw her only at that time.

CHARLES DAWSON.

Deposition of Susan Monahan, taken, subscribed, and sworn to, before N. Austin Parks, examiner.

FEB. 28*th*.

(10th in order of time this day.)

Int. 1. State your name, age, residence, and occupation.

484 Ans. Susan Monahan; residence, Worcester, Mass.; occupation, weaver.

Int. 2. Look at the pieces of cloth now shown you, marked Exhibit H, I, and S, and state if you know by whom they were woven, when, and where.

Ans. They were woven by me—one (I can't say which, they are all alike) a week ago yesterday, at the Hamilton Tape Mill in Worcester. The other two pieces were woven about three weeks ago.

Int. 3. Did you weave any other cloth in that loom except those three pieces; if so, how much more, and when?

Ans. I wove another cut about two weeks ago.

Int. 4. When you wove the cut on yesterday week, was the loom in the same condition as when you wove the three other cuts? If not, what change had been made in it?

Ans. The evener was taken off.

And in answer to cross-interrogatories by J. D. Ball, esq., deponent saith:

Cross-int. 1. When the loom made mispicks, what did you do?

Ans. Stopped it and picked them out.

Cross-int. 2. When did you do that?

Ans. Every time I noticed it.

Cross-int. 3. Were you careful in picking them out?

Ans. I was.

Cross-int. 4. Were you careful in noticing the loom when it made mispicks?

Ans. I was.

Cross-int. 5. Why so?

Ans. Because I wanted the cloth perfect.

Cross-int. 6. Did you make it a point to pick out all the mispicks that you noticed when the loom made them?

Ans. All that I noticed that went across the cloth, I did.

Cross-int. 7. Please state the reason why you were so careful in noticing when the loom made mispicks?

Ans. Because I wanted my cloth perfect.

Cross-int. 8. Did you notice whether or not the shuttles were worn much in weaving on that loom?

485 Ans. I did notice that they were worn.

Cross-int. 9. Much or little in weaving on that loom?

Ans. A little.

And in answer to direct interrogatories resumed by J. E. Maynadier, esq., deponent saith as follows, viz.:

Int. 5. Is it part of a weaver's duty to pick out mispicks in ordinary fancy weaving? If so, why are the mispicks picked out?

Ans. It is part of the duty. The mispicks are picked out so that they will not show on the cloth.

Int. 6. Did you ever work on a fancy loom which made no mispicks?

Ans. I did not.

Int. 7. Suppose the filling breaks or runs out, what is the consequence?

Ans. You must stop your loom and find the right shade, and start it up.

Int. 8. Suppose you don't find the right shade, what is the consequence?

Ans. You would make a wrong place on the cloth.

Int. 9. Do you recollect how many mispicks that loom made yesterday week, in weaving the last half of the cut of cloth woven at that time?

Ans. I do not; I don't remember making any the last half.

Cross-examination resumed by J. D. Ball, esq.:

Cross-int. 10. Do you recollect how many it made in weaving the rest, on the first part of that cloth?

Ans. I do; two.

Cross-int. 11. Do you recollect of the shuttle flying out?

Ans. I do not remember that it did.

SUSAN MONAHAN.

486 *Deposition of Horace Wyman (recalled), taken, subscribed, and sworn to before N. Austin Parks, examiner.*

FEB. 28*th.*

(11th in order of time this day.)

Int. 1. Have you before testified in this case?

Ans. I have.

Int. 2. Were you present on the 11th and 12th of this month at the Hamilton Tape Mill where the Marshall loom built under your direction then was? If so, did you observe the picking roll fall off that loom; and if so, who put it on again?

Ans. I was present. I observed the loom stopped, and examined and found that the picking roll had fallen off, and directed Mr. Tetlow to put it on again, which he did.

Int. 3. Were you present when it was put on?

Ans. Before it was put on I left the mill.

Int. 4. On Wednesday of last week, what was done upon that loom?

Ans. A cut of cloth was woven without the evener in operation.

Int. 5. How do you know there was no evener then in operation on the loom?

Ans. I removed it with my own hands and locked it up in Mr. Crompton's shop.

Int. 6. When was that cut of cloth finished—as to the weaving I mean?

Ans. It was finished last week, Wednesday evening, about 6 o'clock, I should say.

Int. 7. Was the evener then put upon the loom again; if so, why?

Ans. It was put upon the loom for the purpose of running the loom with and without the evener.

Int. 8. Did you have directions from Mr. Crompton to deliver this loom to Mr. Thomas; if so, at what time were you directed to have the loom ready for delivery?

487 Ans. I did. To have it ready on Thursday morning of last week when the 10 o'clock train arrived from Boston.

Adjourned to 7 p. m.

Resumed:

Int. 9. Look at Exhibit R, now shown you, and state when it was woven, on what loom, and where.

Ans. It was woven, part of it, yesterday—the other part on Friday of last week, and about two yards of it I don't know when it was woven. It was after the loom was given up to Mr. Thomas and while in his possession—on the Marshall loom at the Hamilton Tape Mill at Worcester.

Int. 10. State what part of it was woven last Friday.

Ans. About six yards of it of plum-color, terminating with the piece of red tape.

Int. 11. Who was present on that occasion, and who did the weaving?

Ans. Mr. Tetlow did the weaving; no one else was present except myself.

Int. 12. Did the loom have an evener on it when that was woven or not?

Ans. It did for part of the time and part of the time it did not; every alternate half yard had the evener on, and the other alternate half yard had it off.

Int. 13. You stated that you were instructed to be ready to deliver up the loom to Mr. Thomas on Thursday morning at 10; when did you deliver it to him in fact?

Ans. Last Friday afternoon; he took possession of it there. It was not removed from that place.

Int. 14. You say you wove about six yards of Exhibit R on Friday. Was that warp removed from the loom, or was the warp left in the loom and delivered to Mr. Thomas with the loom? I mean by warp to include that part of it which was woven—the first six yards of Exhibit R.

488 Ans. It was left in the loom, and Mr. Thomas took possession of it. I mean the first six yards with the warp.

Int. 15. When was that loom given back again by Mr. Thomas, and state whether it had a warp in it, at that time, partly woven, and if so, what warp was in it?

Ans. It was given back yesterday morning (27th), or we took possession of it yesterday morning. I don't know what time Mr. Thomas gave it up. There was no warp in the loom. The warp we left in was taken out and lying by the side of the loom, with about two yards woven after I left it in Mr. Thomas's possession.

Int. 16. Did you weave any more on the loom yesterday? If so, who were present and what goods did you weave?

Ans. There was none wove under my direction. Mr. Dawson and Mr. Tetlow were present. I wove the remainder of this Exhibit R. I mean the parti-colored part of that exhibit.

Int. 17. When you started that loom yesterday, how did it work?

Ans. It made mispicks.

Int. 18. State whether or not you find any alterations in the adjustment necessary, or any parts which required to be removed or replaced?

Ans. I found it necessary to make an adjustment in the chain cylinder in its relation to the lower latches.

(Counsel for Mr. Crompton states that the inquiry was as to whether any adjustments were necessary—not as to what adjustments were necessary.)

Ans. I did find adjustments necessary, and also renewal of one part.

Int. 19. While the parti-colored part of Exhibit R was being woven, was or not the evener upon the loom?

Ans. Every alternate yard had the evener on; the other yards had it off.

Int. 20. Do you know Joseph Clissold, who was examined this morning? If so, state whether he was ever employed by Mr. Crompton.

Ans. I do know him. He was employed by Mr. Crompton.

Int. 21. What was he hired for, and why did he leave?

Ans. He was hired for the purpose of starting new looms—

489 going out with them to start them. We found him incompetent to do that, and he was discharged.

Int. 22. Do you know of the shuttle used in the Marshall loom being planed? If so, when was it planed, and why?

Ans. I do know of its being planed. It was for the purpose of accommodating itself to the smaller-sized shed which the loom was found to make when running without an evener. It was planed at the time we commenced running it without an evener. The shuttle, so reduced in size, was still amply sufficient to protect the bobbin in its passage through the warp.

Int. 23. Are the same sized shuttles always used in looms of different sizes? I mean in fancy looms making different widths of shed.

Ans. Different sizes are used. The size of the shuttle is governed by the size of the bobbin which the shuttle is designed to protect in its passage through the warp. I've seen them very much smaller and also very much larger than this one, used in fancy weaving.

Int. 24. Did you see any pattern chains in the room where the loom was used after Mr. Thomas gave it up, other than the pattern chain used by you in the loom?

Ans. I did not. I saw Mr. Schofield have some in his possession which he stated were the ones that were used on the Marshall loom while they were running it.

Int. 25. You say when "they" were running it—whom do you mean by they?

Ans. Mr. Thomas, with Mr. Schofield's assistance, as I understood it.

Int. 26. Did you examine those chains; if so, what was their condition?

Ans. I examined some of the rolls on the chains, and found the holes in them very much eccentric to the circumference.

Int. 27. What would be the effect of using such rolls in the pattern chain of the Marshall loom?

Ans. The effect would be, when one of those imperfect rolls operated upon the jack, and the jack was carried to its depressed position under the lower set of latches, if another imperfect roll should immedi-
490 ately succeed the previous one (indicating that the jack should remain in that depressed position), the imperfection of either one or both rolls would allow the jack to unlatch from the lower set of latches and make a mispick.

Int. 28. Do you know of a Crompton broad open-shed fancy loom that was sent to the Washington Mills at Lawrence?

Ans. I do.

Int. 29. How long was the pattern chain in that loom?

Ans. It was between 37 and 38 feet long—nearly 38 feet; I mean the one sent to start the loom with.

Int. 30. Was there any other broad open-shed fancy loom sent to that mill from Crompton Loom Works?

Ans. There was not.

Int. 31. Was the pattern set up on the chain when that loom left the works?

Ans. It was.

Int. 32. How broad was that loom?

Ans. 118 inches in the reed.

Int. 33. What is the usual width of a broad fancy loom?

Ans. 92 inches in the reed of a broad fancy loom.

And in answer to cross-interrogatories by J. D. Ball, esq., deponent saith as follows:

Cross-int. 1. Do you recollect who Mr. Crompton sent to run that loom sent to the Washington Mills?

Ans. I do. His name is Lewis, and we subsequently ascertained that he was a very incompetent man to start a loom.

Cross-int. 2. Is the last part of your answer to the preceding question called for by the question, or was it volunteered by you?

Ans. It was volunteered by me.

Cross-int. 3. How long had that man been in Mr. Crompton's employment before he was sent to run that loom?

Ans. I do not recollect.

Cross-int. 4. State as nearly as you can.

Ans. Perhaps for a month; I cannot state the time nearer.

Cross-int. 5. Do you mean to swear here that that man had not been in his employment more than a month?

491 Ans. I've no recollection of the matter whatever. There are so

many men employed at the establishment that are constantly leaving and new ones coming, that I cannot remember the time that any particular one remained.

Cross-int. 6. Do you mean to swear that that man had not been in Mr. Crompton's employment as much as a year before he was sent to run that loom?

Ans. For the purpose of his employment by Mr. Crompton as a starter of looms, I do so mean to swear.

Cross-int. 7. Please answer the previous question, if you have no objection?

Ans. My best recollection is that he was not in his employ for a year in any capacity. My impression is that I was not in the shop a year previous to the loom being sent, and this man came after I did.

Cross-int. 8. How was a pattern chain of the length of the one that you have referred to as sent to the Washington Mills usually arranged when working in a loom?

Ans. I don't know. I never saw a long pattern chain working in a loom.

Cross-int. 9. Then do I understand you to say that you havn't sufficient experience to answer the question?

Ans. I am not a practical weaver and have no practical experience in running the chains except this one on the Marshall loom, and perhaps once or twice previously in experimenting with looms.

Cross-int. 10. Does Mr. Crompton make pattern chains like those used on the so-called Marshall loom?

Ans. He does.

Cross-int. 11. How are the cam rollers on those chains made?

Ans. They are first cast, then chucked or a hole drilled through them, and at one time we turned all the rolls in a lathe; lately we fastened several together on an arbor passing through the holes, and grind them by revolving them before a stone.

Cross-int. 12. Do those cam rollers which Mr. Crompton makes, generally give satisfaction?

Ans. So far as I am aware, they do.

492 Cross-int. 13. Do they generally run well on the Crompton close-shed fancy looms?

Ans. I presume they do.

Cross-int. 14. Do you know whether the cam rollers, which you say in your answer to the 26th interrogatory you examined, were made by Mr. Crompton?

Ans. I do not know that they were made by Mr. Crompton.

Cross-int. 15. Were they new?

Ans. I couldn't say in regard to that. I did not observe. I should think they were comparatively new.

Cross-int. 16. To how many did you call Mr. Schofield's attention?

Ans. I noticed that several were imperfect, and I called his attention to perhaps three or four.

Cross-int. 17. How many were imperfect?

Ans. I did not examine all the rolls on the chains; I saw perhaps four or five imperfect ones.

Cross-int. 18. To what extent are you willing to swear the holes were eccentric to the circumference?

Ans. Enough in my opinion to cause mispicks on the Marshall loom.

Cross-int. 19. Please answer the preceding question, if you've no objection?

Ans. I did not determine when examining them in my mind what their eccentricity was, and cannot therefore give any definite figures.

have caused the seal of the Patent Office to be hereunto affixed, this eighteenth day of February, in the year of our Lord one thousand eight hundred and sixty-seven, and of the independence of the United States the ninety-first.

T. C. THEAKER.

To the honorable Commissioner of Patents:

The petition of Moses Marshall, of Lowell, in the commonwealth of Massachusetts, respectfully represents—

That he is the original and first inventor of certain improvements in fancy looms, for which he obtained letters patent of the United States, dated December, 1849, afterwards reissued 24th April, 1860.

That said improvements are of great value to the public, but that he has, without neglect or fault on his part, failed to obtain from the
497 use and sale of his invention a reasonable remuneration for the time, ingenuity, and expense bestowed upon the same, and the introduction thereof into use.

Wherefore he submits that it is just and proper that his said patent should be, and he prays that it may be, extended for the further term of seven years; he having paid fifty dollars into the treasury of the United States, and otherwise complied with the acts of Congress in such cases made and provided.

5th August, 1863. MOSES MARSHALL.

LOWELL, *7th August*, 1863.

Hon. D. P. HOLLOWAY, *Commissioner of Patents:*

SIR: I hereby appoint and have to request that you will recognize Mr. A. B. Stoughton, of Washington, my attorney, to present and prosecute my application for extension of letters patent, granted to me 11th December, 1849, and reissued 24th April, 1860, for improvements in fancy looms.

Your obedient servant,

MOSES MARSHALL.

UNITED STATES PATENT OFFICE,
Washington, August 14, 1863.

On the petition of Moses Marshall, of Lowell, Mass., praying for the extension of a patent granted to him the 11th day of December, 1849, for an improvement in looms for weaving figured fabrics, for seven years from the expiration of said patent, which takes place on the 11th day of December, 1863.

498 It is ordered that the said petition be heard at the Patent Office, on Monday, the 23d day of November next, at 12 o'clock m.; and all persons are notified to appear and show cause, if any they have, why said petition ought not to be granted.

Persons opposing the extension are required to file in the Patent Office their objections, specially set forth in writing, at least twenty days before the day of hearing; all testimony filed by either party to be used at the said hearing must be taken and transmitted in accordance with the rules of the office, which will be furnished on application.

The testimony in the case will be closed on the 9th day of November next; depositions and other papers relied upon as testimony must be filed in the office on or before the morning of that day; the arguments, if any, within ten days thereafter.

Ordered, also, that this notice be published in the "Chronicle," Wash-

ington, D. C.; and the "Journal," Boston, Mass., once a week for three successive weeks; the first of said publications to be at least sixty days previous to the day of hearing.

D. P. HOLLOWAY,
Commissioner of Patents.

P. S.—Editors of the above papers will please copy, and send their bills to the Patent Office, with a paper containing this notice.

In the matter of the application of Moses Marshall, for extension of his patent granted 11th December, 1849, and reissued April 24th, 1860, for improvement in looms for weaving figured fabrics.

Statement.

I have the honor to submit the following statement of the ascertained value of my invention and of my receipts and expenditures on account thereof:

499 My invention relates to that class of looms for weaving figured and fancy fabrics in which a series of leaves of heddles are operated by jacks elevated and depressed by a lifter and depresser, as their position, to suit the design to be woven, is determined by a pattern chain, or any of the known equivalent devices for determining the pattern.

The first part of my invention has for its object to avoid moving any of the leaves of heddles which are not required to be moved for the production of the design during any part of the operation, so that the movements of the heddles and warps in opening and closing the sheds shall be limited to such of the warps as are at the time actually required for the production of the design or face of the fabric. And it consists in combining with the series of jacks that lift and depress the leaves, with a lifter and depresser for lifting and depressing the jacks, and with a pattern chain or other equivalent device for placing the jacks in position to be lifted or depressed, a mechanism for holding any of the jacks either in their elevated or depressed position, when the pattern chain or equivalent device does not indicate that they are to be shifted for the production of the fabric that is at the time being woven.

The second part of my invention relates to the method of lifting and depressing the jacks by what are known as lifters and depressers, and consists in imparting an irregular motion to the lifters and depressers by means of eccentric cog gearing so timed relatively to the motions of the loom, that the lifter and depresser shall move with the greatest velocity at the time the warps are crossing to close a shed and open another, the period of so closing a shed being at or about the time the lay beats up the weft thread, so that the warps shall close upon the weft thread before it is relieved by the back movement of the lay. In this way a much closer fabric can be woven than by crossing the warps as the lay returns.

The practical benefits resulting from this improved construction are obvious, and will be shown by proof derived from the actual use of my improved looms.

They consist mainly in the more easy and economical working of the harnesses and warp threads, and in the superior character of the
500 woven goods. They involve a saving of wear and tear of the harnesses, warp threads, and lathe reeds, and a saving in the power required to run the loom for a given class of work, and, by diminishing

the breakages of the warps, increase the weaving capacity of the loom; at the same time, they enable the filling to be woven in more evenly and closely, giving the cloth a better texture and a finer finish. The details of these advantages will be explained in the proof which I expect to submit to the office.

Confining myself, however, to the diminution of breakages of threads and consequent interruptions to the weaving, and the greater ease of working of the loom, owing to the fact that a small part only of the harnesses are required to be moved as the pattern advances (these being matters which go directly to the producing capacity of the loom), I am enabled to state, as the ascertained value of my improvements in these respects, that they enable the fancy loom to work with ease and safety to a considerably higher rate of speed than is practicable by the previous close-shed method, in which all the harnesses are constantly moving—increasing the capacity of the loom, taking its average running on average goods in woollen mills not less than two yards per day—involving a saving in cost of weaving of about ten cents per day, or thirty dollars a year on each loom. Upon the basis of these figures, which will, I believe, be much exceeded by the actual proof, I am justified in saying that on the looms which have been put in use embracing my improvements (which looms for causes to be hereafter explained have been very few in proportion to the acknowledged merit of the looms), there have been already saved in the cost of weaving, by the use of my improvements, not less than twenty-five thousand dollars, and, I believe I state the ascertained value of my invention low, in putting it, as I do, at the amount of fifty thousand dollars.

I now come to the history of my invention of this improved loom, and of its introduction into use.

In the early part of the year 1849, the first working loom containing my said improvements was completed and set to work in the Burlington Manufacturing Company's Mill, at Burlington, Vermont, where I had been for some time employed as machinist. The loom was constructed in all material respects as shown in my patent, and was operated regularly from the time it was set up until the mill failed, and its operation ceased the same year. It will appear by the evidence I shall produce that the loom was a complete success, remedying difficulties which had been long felt by manufacturers, and was regarded with so much favor by the superintendent of the mill and others that the mill, if it had continued in operation, would have been completely stocked with looms of similar construction.

501

I am not able to state with precision the number of days which I spent upon the invention and improvement of my loom, and getting it in successful use at Burlington, but believe it was not less than eight months of pretty constant study and labor.

This loom at Burlington, after the failure of the company, was run for some weeks by their assignees, working up the stock on hand, and was then sold with the other property of the company. I am not at present able to say where it went or where it now is.

In July, 1849, I removed to Lowell, and went immediately to work to make my model and take other necessary steps for procuring my patent. While I was so engaged, I obtained the consent of the Middlesex Manufacturing Company to put up in their woollen mills a loom of my improved construction, the company furnishing the materials, shop, and tools. I made no bargain beforehand for compensation, being satisfied to get the necessary facilities for introducing my loom in a well-known mill, where it would show its capacity. In fact, I was obliged, instead of

building a new loom complete, to take an old loom frame furnished to me by the company for the purpose, and construct my improved harness motion upon it. The loom was finished in October, 1849, and set to work in the Middlesex Mill. Its operation was entirely successful as regarded all that I had put on it, but the frame which had been furnished by the company unfortunately proved to be too weak for the working parts, and the result was that after a short time its use was discontinued.

It had been with difficulty that I obtained permission to introduce my improvements in the Middlesex Mill, and I did not succeed in inducing the company to give me a second opportunity.

At this time, the latter part of 1849, the demand for fancy or
502 figured woollen goods was getting slack, and plain goods, such as doeskins, etc., were taking their place to a great extent, which latter class of goods could be woven to a good advantage on the close-shed looms (Crompton looms) already in use, costing less than mine to build, and with which the woollen mills were already provided. This change in the state of the trade, which continued for a considerable time, operated, I was informed and believe, upon the minds of the managing officers of the Middlesex Mills against any further movement at that time with my improved looms.

I obtained my patent 11th December, 1849, and think I am safe in saying that to the necessary arrangements for so doing, and to the construction and introduction of the Middlesex loom, I gave in all not less than six months of attention, study, and effort.

I was at this time, as I had always been, a machinist by occupation, dependent upon my day's work for support, and seeing that there was no opportunity, and being advised that there was none at that time, for introducing an entirely new harness motion in the fancy mills, a matter which required means and business acquaintance and influence which I did not possess, I devoted myself again to my trade for the support of myself and my family. I have continued ever since to live in Lowell, mainly employed on wages as machinist.

By all accounts which I had for some years after 1849, fancy woollens (which, as I have said, particularly required the use of my improvements) continued to be very little manufactured in this country, and no opening was afforded for getting my improved loom further introduced. As well as I could in my situation in life, I kept myself informed of the prospects of doing something more with my invention, and omitted no opportunity, but was from time to time advised by persons who had better means of judging than I had that it was useless as yet to attempt it.

In 1856 or 1857 the demand for fancy woollens revived again, and has continued with more or less activity ever since, and at the present time is, I am informed and believe, large and steady. But the financial crisis of 1857 made such trouble among the manufacturers of New England that the opportunity which I might otherwise have had for
503 further introducing my invention was entirely lost to me. The manufacturers had already, during that period, more looms on hand than they could then profitably keep running, and for several years were not in condition to extend their work and attempt the introduction into their mills of new and comparatively untried looms.

In 1859, my patent having but a few years to run, and seeing no prospect with any means or influence which I could command of further introducing my improved looms, I became satisfied that the best course for me to pursue was to put my patent into the hands of some established loom builder, who would be in a situation to take advantage of what-

ever opportunity might arise, and by manufacturing my improved looms, in considerable number, if called for, get them economically and favorably into use. I accordingly assigned my patent to Mr. George Crompton, then and now one of the leading fancy loom builders in the country, for the consideration of three hundred dollars, carefully reserving, however, my right to the extension of the patent, if any might be obtained, as I felt confident that my loom would in the end command the general patronage of the manufacturers, and wanted only to avail myself of his capital and business position to get it well introduced. Situated as I was, I believe that I could not have done better as a prudent man, and the price I received for the unexpired term of my patent, three hundred dollars, though extremely small, was as much as, under all the circumstances, I suppose I had a right to expect.

The result justified the view I took of my best interest in the matter. Mr. Crompton has since manufactured a number of looms on the principle of my invention, and they are steadily making their way in the favor of manufacturers.

I should also state that about 1857 another open-shed loom, an infringement of my patent, made its appearance, and came into competition with mine in the attempt to gain the market. This loom had the benefit of the influence of one of the largest mills in the country with which the persons who brought it out were connected, and has since been largely built in competition with my own as built by Mr. Crompton. It was plainly out of the question for a man in my position to meet this difficulty, in addition to those which already existed as before mentioned.

504 A circumstance which has tended strongly to bring out the value of my improved loom since 1859, is the introduction in New England, to a much larger extent than previously, of the manufacture of fancy cottons. In this manufacture, for reasons not necessary to be now explained, my improved looms are used to even greater advantage than in woollens.

It thus appears, and my several statements above made will be fully sustained by evidence to be submitted in due time, that I have used what, under the circumstances, must be acknowledged to be proper diligence and perseverance in the effort to realize a just remuneration from the use and sale of my invention, and that I have been so far prevented from doing so by circumstances with which I was entirely unable to contend; also, that partly by reason of the course which I at last adopted, and partly by favorable changes in business since, there appears to be a good prospect of making profitable use of my invention in future.

I now proceed to state my account of receipts and expenditures, as required by law.

Received from George Crompton	$300 00
Expended:	
Paid for building Patent Office model, materials, extra help, shop-rent, &c	150 00
Paid expense of obtaining patent	183 43
" cost of patterns for model	45 00
" cost of loom for Middlesex Co	178 84
" two trips to get castings	8 75
	$566 02

Showing an actual pecuniary loss which I have sustained on account of my patent of $266 02.

MOSES MARSHALL.

SEPT. 8*th*, 1863.

COMMONWEALTH OF MASSACHUSETTS, *Suffolk, ss:*

On this 8th day of September, A. D. 1863, personally appeared
505 the above-named Moses Marshall, and made oath that the foregoing statement by him signed is true.

Before me,

W. J. FORSAITH,
Justice of the Peace.

I hereby certify that the affidavits of Thomas Barrows, John Campbell, and George Crompton, relating to the matter of the application of Moses Marshall for extension of his patent of 11th Dec., 1849, reissued April 24th, 1860, for improvements in fancy looms were taken, sealed up, and addressed to the Commissioner of Patents by me.

N. AUSTIN PARKS,
Justice of the Peace.

To the honorable the COMMISSIONER OF PATENTS,
Washington, D. C.

Opened by me to allow party to affix stamps that had been omitted by oversight, Oct. 31st, 1863.

E. B., *Draughtsman.*

Received and filed Oct. 28th, 1863.

E. B.

In the matter of the application of Moses Marshall.

Thomas Barrows, of lawful age, being duly sworn, says:

I have been for over thirty years practically acquainted with, and engaged in the overseeing, or in charge of fancy looms, for weaving fancy or figured fabrics. For thirty-eight years ending last August, I was agent of the Maverick Woollens Company's Mill, at Mill Village, Dedham, engaged in the manufacture of fancy goods. We have used
506 among others the old and the modern Crompton looms, and we have also thirty-eight "open-shed" looms purchased since 1849. We purchased eighteen in the first place, and after using them sufficiently to show their decided superiority to the tight-shed looms, we purchased twenty more; they were built by Mr. George Crompton, of Worcester, under Mr. Marshall's patent above mentioned. By "open shed," I mean that those harnesses which are lifted or depressed at any stage of the weaving are kept in that position so long as the course of the pattern does not require them to be shifted. I have had for over thirty years a very fair knowledge of the different kinds of looms in use in this country for fancy weaving, and have never heard of any attempt to accomplish this new mode of weaving prior to the date of Mr. Marshall's patent. His improvement is, in my opinion, entirely new, and shows much ingenuity; and is of decided practical value in the art of fancy power-loom weaving.

Its advantages are briefly, that by reducing the number of warps to be moved at each operation of the loom to the comparatively small number which the course of the pattern requires to be shifted, the average work of the loom is much lightened and the loom enabled to run to a considerably higher speed with advantage; there is less wear to the harnesses and lathe reeds; there is less chafingof warp threads, and consequently less breakage with the same weight of yarn; the character

of the woven goods is much better, owing to the closer lay of the filling, and consequently more even and firm texture to the cloth, and owing to the "superior dress" upon the surface. In my judgment, the fancy goods woven on these open-shed looms are worth more in the market, owing to the advantages growing directly out of the open-shed mode of operation.

I know of no reason why they should not go rapidly into use, to a much larger extent than heretofore; their superiority for practical purposes being unquestionable, when they are fairly tried.

I am now engaged in fitting up a fancy mill of my own at Dedham, and have ordered these open-shed looms (good looms) of Mr. Crompton, though at a cost of twenty-five dollars more per loom than I should pay for tight-shed looms similar in other respects.

THOMAS BARROWS.

507 STATE OF MASSACHUSETTS, *Suffolk, ss:*

At Boston, in said county, on the 21st day of October, A. D. 1863, before me personally appeared the above-named Thomas Barrows, and made oath that the foregoing affidavit by him subscribed contains the whole truth and nothing but the truth. The said affidavit is taken at the request of Moses Marshall, to be used upon the hearing of an application for extension of his patent, dated 11th Dec., 1849, reissued 24th April, 1860, for improvement in fancy looms, before the Commissioner of Patents of the United States at his office. Certified by me.

N. AUSTIN PARKS,
Justice of the Peace.

In the matter of the application of Moses Marshall for extension of his patent, granted 11th December, 1849, and reissued 24th April, 1860, for improvement in looms for weaving figured fabrics.

John Campbell, of lawful age, being duly sworn, says:

I reside in Dedham, Massachusetts, and am overseer of weaving room of the Maverick Woollens Company's Mill, at Mill Village, in that town. I have held that position for three years and the position of second hand for the three years previous, and have been in that company's mill and elsewhere occupied as a practical weaver for seventeen years on power looms, and during the early years of my life on hand looms.

The Maverick Woollens Company make fancies and other woollen goods. They have at present about thirty-eight fancy looms built by George Crompton, of Worcester, upon the plan known as the open-shed, in which the series of jacks that lift and depress the leaves of heddles, and the lifter and depresser for lifting and depressing the jacks, and the pattern chain for placing the jacks in position to be lifted or depressed, are combined with a mechanism for holding any of the jacks either in its lifted or depressed position, when the pattern chain does not indicate that it is required to be shifted to produce the pattern that is at the time being woven. I have examined a certified copy of the patent
508 of Moses Marshall which he now applies to have extended, and find represented in the drawings a mechanism such as I refer to, and such as is upon the open-shed fancy looms we use in the Maverick Woollens Company's Mill.

I have had constant occasion to observe the working of these looms as compared with the Crompton fancy looms, so-called, which have a "tight shed," that is moving all the warps up and down at every beat of the lathe whether the pattern requires any particular warp thread to

be shifted for the next throw of the shuttle or not. Some of these last-named looms are running in the mill now, and I have long been acquainted with their practical operation.

Owing to the fact that the amount of harness to be moved at each operation of the loom is so much less, namely, about one-fourth part of the whole on an average, instead of the whole, and owing also to the fact that there is proportionately less resistance to the beating up of the lathe, I have observed very decided advantages of these "open-shed" looms over the Crompton "tight-shed" looms. They run to eighty-five picks per minute, and the tight-shed looms run only to seventy-five, and at these rates the former run also more easily than the latter. Taking our weaving of military goods, which for several years past have constituted the bulk of our work, as a standard, I think there is a difference of from three to five yards production per day on each loom in favor of the open-shed looms. These goods are woven at a cost of two and a half to three cents a yard—making a saving of from ten to fifteen cents in the cost of weaving daily per loom—or from thirty to forty-five dollars annual saving in the cost of weaving on each loom. These figures I believe to be below the fact. They are based upon the greater rapidity with which the looms can be advantageously worked in consequence of the reduced number of movements of the harnesses and warps.

There are, however, many other advantages in the "open-shed," looms going to increase the practical speed of the looms still more, or to improve the quality of the woven goods. Thus there is with the same weight of yarns decidedly less breakage of warps with the "open-shed" than with the "tight-shed" looms; and the harnesses of the former last considerably longer than those of the latter. There is a
509 marked superiority in the woven cloth, the filling in the "open-shed" looms laying in closer to the fell, making a more firm and even fabric; the cloth also showing a superior dress, or richness of face, by reason of the filling lying more full on the face of the cloth. This is always sought for in fancy weaving, but is materially hindered in the tight-shed looms by the constant play, up and down, of he whole series of warp threads.

For these reasons the goods woven by the "open-shed" looms are decidedly superior in my judgment to those woven by the "close-shed" looms; so much so, that if there were no gain in the amount of production by the former over the latter, they would still be worth much more to a woollen manufacturer than the difference in the first cost of the looms.

I am generally acquainted with the fancy looms in use to any extent in this country during the last seventeen years, and have never heard of any "open-shed" loom being used prior to the date of Mr. Marshall's patent.

(The word "three" substituted for "six" and eleven words first inserted.)

JOHN CAMPBELL.

STATE OF MASSACHUSETTS, *Suffolk, ss:*

At Boston, in said county, on the 21st day of October, A. D. 1863, before me personally appeared the above-named John Campbell, and made oath that the foregoing affidavit by him subscribed contains the whole truth and nothing but the truth.

The said affidavit is taken at the request of Moses Marshall, to be used upon the hearing of an application for an extension of his patent, dated 11th Dec., 1849, reissued 24th April, 1860, for improvements in

fancy looms, before the Commissioner of Patents of the United States at his office.

Certified by me.

N. AUSTIN PARKS,
Justice of the Peace

510 In the matter of the application of Moses Marshall for extension of his patent, granted 11th December, 1849, and reissued 24th April, 1860, for improvement in looms for weaving figured fabrics.

George Crompton, of lawful age, being duly sworn, says:

I reside in Worcester, Massachusetts, and have been a fancy loom builder by occupation for about twelve years, and have incidentally acquired in such business a fair knowledge of fancy weaving as actually practised by the use of looms of the class to which those of my make belong.

Having read the affidavit of Mr. John Campbell in this case, I have to say that I agree with his statement of the merits of the open-shed looms made under the Marshall patent, and I think he has stated the same fairly and moderately.

I also state that I know of about one hundred cotton fancy looms which have been in use for about two years in Massachusetts, and fifty to a hundred woollen fancy looms now building, not of my make, open-shed looms; that is, having the jacks, lifter and depresser, and pattern chain, combined, as in the Marshall patent, with a mechanism by which the harnesses not required by the course of the pattern to be shifted, are kept in their lifted or depressed condition, as the case may be, the particular mechanism differing in construction from the particular mechanism employed in the Marshall patent, but operating in the same way in combination with the other parts named, and producing the same result. I have notified the users of these looms of their infringement upon the Marshall patent, of which I am the owner of the original term; but have not, upon reflection, thought it worth my own while to commence suit, because the great expense which the litigation would involve, and which the interest of the defendants would justify them in incurring, made it not worth while to me to sue them for the damages which I could recover for the short time remaining of the term of the patent.

I think, from my knowledge of the loom business, that there is every reason to expect a large and increasing demand for the open-shed looms for some years to come, and that the slight demand for them until late years, and the failure of Mr. Marshall to get them introduced
511 prior to 1859, when he sold me the patent, are due to circumstances independent of the value of his invention, and entirely beyond his control.

GEORGE CROMPTON.

STATE OF MASSACHUSETTS, *Suffolk, ss:*

At Boston, in said county, on the 21st day of October, A. D. 1863, before me personally appeared the above-named George Crompton, and made oath that the foregoing affidavit by him subscribed contains the whole truth and nothing but the truth.

The said affidavit is taken at the request of Moses Marshall, to be used upon the hearing of an application for extension of his patent of 11th Dec., 1849, reissued April 24th, 1860, for improvements in fancy looms, before the Commissioner of Patents of the United States, at his office.

Certified by me.

N. AUSTIN PARKS,
Justice of the Peace.

I hereby certify that the affidavits of James Cook, Warren Aldrich, and Levi B. Tyng, relating to the matter of the application of Moses Marshall for extension of his patent dated 11th Dec., 1849, reissued 24th April, 1860, for improvements in fancy looms, were taken, sealed up, and addressed to the Commissioner of Patents by me.

GEORGE F. RICHARDSON,
Justice of the Peace.

Hon. D. P. HOLLOWAY, *Commissioner of Patents, Washington, D. C.*

Received and filed, Oct. 31, 1863.

E. B.

512 In the matter of the application of Moses Marshall for the extension of his patent, dated 11th December, 1849, reissued 24th April, 1860, for improvements in fancy looms.

Before the Commissioner of Patents.

James Cook, of lawful age, being duly sworn, says:

I reside in Lowell, and am secretary of the Lowell Mutual Insurance Company, and agent for six or eight other insurance companies.

I was for more than thirty years connected with the woollen manufacture in the United States, part of which time I was agent of the Middlesex Mills; at another period, agent of the Burlington Manufacturing Company, at Burlington, Vermont.

In the early part of the year 1849, while I was agent of the Burlington Mills, Mr. Moses Marshall, the petitioner, then employed in the mills, produced his open-shed fancy looms, represented in his patent above named.

We had been previously using in the mill the common close-shed fancy looms, in which we had found various objections, owing to the fact that the whole body of the warp threads was moved at every beat of the lathe. The lathe beating up at or near the moment when the warp threads were crossing to form a new shed, had to make its way through the whole mass of wharp threads, which lay in about a horizontal position, and in a slack state; the result of which was that the warp threads were frequently kinked and broken by the lathe reed; the lathe reed itself was exposed to great wear and tear; the warp threads themselves and the harnesses were much worn. In regard also to the cloth woven on these looms, an objection was found from the fact that the whole body of warps playing up and down at each movement of the lathe, the filling was prevented from being regularly laid full upon the face of the cloth, as it was meant to do, to give richness to the surface.

Mr. Marshall's open-shed loom, in which no warp threads were moved until the course of the pattern required it to appear on the other part was a great improvement in these respects. It ran but a short time, as the mill failed a few weeks after it was introduced; and after assisting to work up the stock on hand, under direction of the assignees, it was sold with the other property of the company.

513 This was Mr. Marshall's first loom on his open-shed principle, and was of course more expensive and worked less smoothly than might be expected from others like it to be made afterwards. It was, nevertheless, a decided success. It made better faced goods than the old looms, and effected a great saving in the wear and tear of the parts I have mentioned, particularly the harnesses. On the old looms weaving with close shed, a set of harnesses lasted less than two months in constant use; whereas with the open shed of Mr. Marshall it would last, judging from what was done at Burlington, as long again. In the Bur-

lington Mills we averaged in all about two hundred harnesses, the cost of which was about five dollars a set. In the fancy looms of New England there are generally about twenty-five harnesses to a set of cards. In our fancy mill at Burlington we used from six to not more than twelve sets of cards. This is probably one-hundreth part of the fancy weaving now carried on in New England, and to which the open-shed system of weaving is applicable.

Mr. Marshall's loom was so successful, and answered so completely the wishes of the company, that I have no doubt they would have been introduced throughout the mill but for our failure, which occurred in the spring of 1849. The results accomplished by his loom were those which had been long sought for among fancy manufacturers.

Mr. Marshall, I think, bestowed a great deal of labor and study upon getting up his new loom, and getting it started in our mill. For the greater part of the year before the failure of the company, I should say that he was so occupied almost constantly. And at that time I believe nothing but our failure prevented him from realizing a handsome profit by the introduction of his looms into our mill. How he fared afterwards, and what efforts he made to get his loom introduced elsewhere, I do not personally know. I know, however, that it must have been difficult, if not impossible, for him to do so, because in that same year, 1849, the demand for fancy goods declined, and doeskins and other plain-faced goods, which could be just as advantageously made on other and much cheaper looms, came into fashion. It so continued until 1856 or 1857, when the call for fancy goods revived again, and looms like Mr. Marshall's became again highly desirable and have been so ever since. But the state of manfacturing business was such in 1857, in New England, and for some time afterwards, that he must have found it a very difficult matter to get manufacturers to venture any considerable investment in looms of new construction. The mills had more looms on hand than they were able profitably to use for some time.

514

JAMES COOK.

STATE OF MASSACHUSETTS, *Middlesex County, ss:*

At Lowell, in said county, on the 26th day of October, A. D. 1863, before me personally appeared the above-named James Cook, and made oath that the foregoing affidavit, by him subscribed, contains the whole truth and nothing but the truth.

The said affidavit is taken at the request of Moses Marshall, to be used upon the hearing of an application for the extension of his patent, dated Dec. 11th, 1849, reissued 24th April, 1860, for improvements in fancy looms, before the Commissioner of Patents of the United States, at his office.

Certified by me.

GEORGE F. RICHARDSON,
Justice of the Peace.

In the matter of the application of Moses Marshall for extension of his patent, dated 11th December, 1849, and reissued 24th April, 1860, for improvement in looms for weaving figured fabrics.

Before the Commissioner of Patents.

Warren Aldrich, of lawful age, being duly sworn, says:

I reside in Lowell, Massachusetts, and am a machine builder.

I have known Mr. Moses Marshall, the applicant, since the summer of 1849, when he came from Burlington, Vermont, to live in Lowell, where he has lived ever since.

515 He brought with him to Lowell an improvement in fancy looms, consisting in keeping the shed always open, except as the course of the pattern required any one or more of the warp threads to be shifted from one part of the shed to the other, such improvement being known as the "open-shed" improvement, and being the same shown in his letters patent above mentioned, a copy of which I have examined.

From the 4th July to about Christmas in the year 1849, when he came to work with myself and Mr. Tyng, then partners, during which interval I saw him very frequently, his whole time and attention appeared to be given to this improvement, getting a model of it made for the Patent Office, and trying in various ways to get it introduced into use. I saw his model repeatedly while it was making. It was a working model, and I have no doubt an expensive thing. Being a first model—that is, not made from existing patterns—it must have been, in proportion, very expensive. I think it not unlikely that it cost him to make as much as a full-sized loom would have done.

At this time Mr. Marshall appeared to be not a man of means, but dependent upon his wages as mechanic, and had a wife and, I think, five children to support. His circumstances have remained about the same ever since, so far as I can judge from frequent intercourse with him as a townsman and neighbor.

WARREN ALDRICH.

STATE OF MASSACHUSETTS, *Middlesex Co., ss:* OCT. 28, 1863.

At Lowell, in said county, on the 28th day of October, A. D. 1863, before me personally appeared the above-named Warren Aldrich, and made oath that the foregoing affidavit by him subscribed contains the whole truth and nothing but the truth.

The said affidavit is taken at the request of Moses Marshall, to be used upon the hearing of an application for the extension of his
516 patent dated 11th December, 1849, reissued 24th April, 1860, for improvement in fancy looms, before the Commissioner of Patents of the United States, at his office.

Certified by me.

GEORGE F. RICHARDSON,
Justice of the Peace.

In the matter of the application of Moses Marshall for extension of his patent dated 11th December, 1849, and reissued 24th April, 1860, for improvement in looms for weaving figured fabrics.

Before the Commissioner of Patents.

Levi B. Tyng, of lawful age, being duly sworn, says:

I reside in Lowell, Mass., and am a machinist by occupation. I have read Mr. Aldrich's affidavit in this case, and believe the facts therein stated to be true. I may mention in addition to them that from July, 1849, to the end of the year, Mr. Marshall paid close attention to the matter of getting his open-shed loom introduced by manufacturers; and I myself, by his request, brought several persons to examine his model who were likely to be of service to him in getting the invention introduced.

LEVI B. TYNG.

STATE OF MASSACHUSETTS, *Middlesex County, ss:*

At Lowell, in said county, on the 26th day of October, A. D. 1863, before me personally appeared the above-named Levi B. Tyng, and

made oath that the foregoing affidavit, by him subscribed, contains the whole truth and nothing but the truth.

The said affidavit is taken at the request of Moses Marshall, to be used upon the hearing of an application for the extension of his
517 patent dated 11th December, 1849, reissued 24th April, 1860, for improvements in fancy looms, before the Commissioner of Patents of the United States, at his office.

Certified by me.

GEORGE F. RICHARDSON,
Justice of the Peace.

I hereby certify that the affidavit of John Harding, relating to the matter of the application of Moses Marshall for extension of his patent of December 11, 1849, reissued 24th April, 1860, for improvement in looms for weaving figured fabrics, was taken, sealed up, and addressed to the Commissioner of Patents by me.

HENRY L. HALLETT,
Justice of the Peace.

To the COMMISSIONER OF PATENTS, *Patent Office, Washington, D. C.*

Received and filed November 5, 1863. E. B.

In the matter of Moses Marshall's application for the extension of his patent granted 11th December, 1849, and reissued April 24, 1860, for improvements in looms for weaving figured fabrics.

John Harding, of Lowell, Massachusetts, of lawful age, being duly sworn, says:

I am a weaver by occupation, and have been such for about twenty-five years.

My first acquaintance with Mr. Moses Marshall was when he came to Lowell, in or about the year 1849, and got his improved fancy loom, known as the open-shed loom, introduced into the Middlesex Mill at that place.

The loom set up there was constructed by adapting his improvements to an old loom belonging to the company.

518 I was at that time overseer of the weaving room in which this Marshall loom was set up and worked, and had personal knowledge of its construction and operation. The loom was in operation only a short time, during which it showed itself to possess important advantages by reason of its keeping an open shed; that is, keeping the warp threads up until the pattern required them to go to the under side of the shed, and vice versa. So far as its principle was concerned, it was entirely successful. But the frame of the loom which had been selected to convert into a Marshall loom (one which the company provided him with for the purpose) proved to be too light, and several parts of it (independent entirely of Mr. Marshall's improvements) broke down in the operation of the loom and had to be repaired, so that no satisfactory test was obtained of the amount of advantage due to the improvements put in by Mr. Marshall.

There was considerable objection made beforehand to permitting the Marshall loom to be introduced in the mill, on the ground that the manufacture of fancy goods was getting to be very light about that time, and cam looms well enough adapted to weave doeskins and similar fabrics would come much cheaper. This disinclination to the use of the loom, together with the weakness of the frame in which his improvements had been put, and the consequent interruptions to its working, led to its being soon taken down.

Except the two matters mentioned, I never heard any objection made to its use in the mill; and I have heard it considerably talked about there at that time and since.

In fact, the trial given to the loom was much too short to do it justice—too short to enable the girl to get into the way of its operation, and get its full work out of it.

The subject of an open loom had been already talked about in the Middlesex Mill, particularly Mr. Everett, the designer of the company, had spoken of getting up one himself. Mr. Everett subsequently became connected with Mr. Thomas, a patentee of an open-shed loom.

JOHN HARDING.

519 COMMONWEALTH OF MASSACHUSETTS, *Suffolk County, ss:*

Subscribed and sworn to this 20th day of July, 1863, before me.

HENRY L. HALLETT.

STATE OF MASSACHUSETTS, *Suffolk County, ss:*

At Boston, in said county, on the 20th day of July, A. D. 1863, before me personally appeared the above-named John Harding, and made oath that the foregoing affidavit by him subscribed contains the whole truth and nothing but the truth.

The said affidavit is taken at the request of Moses Marshall, to be used upon the hearing of his application for an extension of his patent for improvements for looms for weaving figured fabrics, dated 11th December, 1849, reissued 24th April, 1860, before the Commissioner of Patents, at his office.

Certified by me.

HENRY L. HALLETT,
Justice of the Peace.

Received and filed Nov. 5, 1863. E. B.

I hereby certify that the affidavit of Isaac Austin, within enclosed, relating to the application for extension of this patent by Moses Marshall to be heard before the Commissioner of Patents, was taken, sealed up, and addressed to the said Commissioner by me.

IRA COLBY, JR.,
Justice of the Peace.

Hon. D. B. HOLLOWAY,
Commissioner of Patents, Washington, D. C.

520 In the matter of the application of Moses Marshall for extension of his patent dated 11th December, 1849, reissued 24th April, 1860, for improvements in fancy looms.

Before the Commissioner of Patents.

Isaac Austin, of lawful age, being duly sworn, says:

I reside in Claremont, New Hampshire. I have been a practical weaver, man and boy, for about fifty years; first in England, and since 1836 in this country. I wove the first piece of fancy goods that was woven in America, and am very well acquainted practically with fancy weaving in general. My last employment was as overseer of the weaving room of the Burlington Manufacturing Company, at Burlington, Vermont. Since that time I have repeatedly had occasion to set up and start new fancy looms in different mills.

I have a good recollection of Mr. Moses Marshall's improved loom

called the open-shed loom, patented December 11th, 1849, and which was first put in operation in the early part of that year at the Burlington's Company's Mill. I assisted to set it up and start it myself, with a man under me; I did all the weaving which was done on that loom there before the company failed. The loom, being new, and the first of that construction, worked at a disadvantage at first, but remarkably well for a loom of new construction. The principle of its operation, by which the shed was kept open, when not required by the course of the pattern to be changed, was perfectly successful, and showed several decided practical advantages over the old close-shed mode of weaving. The advantages which I observed in the working of this loom at Burlington were, among others, the following: By the close-shed method, the lathe beating up at or near the moment when the shed is closed, the warps are all lying on nearly the same level and in a slack state, and the beating up of the lathe through this mass of slack warp threads has a tendency to kink and break the warp threads, and makes a serious amount of trouble in close-shed weaving. By Mr. Marshall's open-shed plan very few, comparatively, of the warp threads are at the centre line of the shed when the lathe beats, and the difficulty referred to is consequently much diminished. The wear and tear of the lathe reeds driving up through the warps, the wear and tear of the warps themselves by the beating
521 up of the lathe reeds, and by the friction of the filling, and the wear and tear of the harnesses were all reduced considerably by the use of Mr. Marshall's open-shed loom—improving the strength of the cloth, and enabling the harnesses to wear through two or three successive warps; whereas, on the old close-shed looms, one set of harness did not generally more than outwear a single warp. A set of harness costs about five dollars. In the Burlington Mill we averaged in use about one hundred fancy looms, and about two hundred sets of harness. Allowing for the capability of keeping harnesses in working order by mending, I should say that a set of harness would need to be repaired on the close-shed loom as often as once in two months, and, on the open-shed, not more than half as often. Besides this saving in wear and tear of harnesses, warps, and lathe reeds, the much less frequency of breakages of threads and consequent stopping of the loom made a considerable difference in the effective speed of weaving; which difference would be moderately stated at an average of a yard a day on each loom. The cost of weaving fancy goods, such as are woven at Burlington, averaged from four to six cents per yard. The diminution of the movement of harnesses, which takes place at each operation of the loom, also enabled the loom to run at a considerably higher speed than on the close-shed loom.

There are also several points of superiority in the cloth woven by the open-shed plan of Mr. Marshall, such as greater evenness of fabric, superior dress or richness of face of the cloth by reason of the filling lying more full on the face of the cloth, as it is always intended to do in fancy looms, and is materially hindered from doing by the constant play of the whole body of warp threads up and down in the close-shed looms.

The improved operation of fancy looms, as I have undertaken to describe it, brought about by Mr. Marshall's invention, had been long desired in fancy weaving, and the production of his loom was regarded by our company, and I consider it myself, to have been a matter of very great advantage to the fancy manufacture.

The loom which was put in operation there in 1849 gave such decided satisfaction, that the mill (which usually ran about a hundred

522 fancy looms) would undoubtedly have been stocked with them altogether, but for the failure of the mill in the spring of that year.

I have knowledge that Mr. Marshall worked very industriously at the invention and perfecting of his loom, and getting it into satisfactory operation at Burlington—probably eight months or more of pretty constant study and work upon it. As to the period of time between his leaving Burlington and the year 1856 or 1857, I cannot say how much time and attention he actually gave to the matter of further introducing his invention into use; but, from the fact known to me that, during that time and afterwards, the demand for fancy goods was almost entirely suspended (doeskins and fabrics of that class taking their place), I am satisfied that it was out of his power to get his looms introduced by any exertions he could make.

In 1856 or 1857, he came to see me, and opened the subject of getting his loom pattern introduced, and I gave him my judgment that the market was not in such a state that it would be practicable for him to do so.

ISAAC AUSTIN.

STATE OF NEW HAMPSHIRE, *Sullivan County, ss:*

Isaac Austin, of Claremont, in said county, on this 29th day of October, A. D. 1863, before me personally appeared, and made oath that the foregoing affidavit, by him subscribed, contains the whole truth and nothing but the truth.

The said affidavit is taken at the request of Moses Marshall, to be used upon the hearing of his application for an extension of his patent dated 11th December, 1849, reissued April 24, 1860, for improvement in fancy looms, before the Commissioner of Patents of the United States, at his office.

Certified by me.

IRA COLBY, JR.,
Justice of the Peace.

523 STATE OF NEW HAMPSHIRE, *Sullivan County, ss:*

I, Lyman J. Brooks, clerk of the supreme judicial court of New Hampshire, within and for the county of Sullivan, hereby certify that Ira Colby, jr., whose name is subscribed to the annexed certificate, was, at the date of said certificate, a justice of the peace in and for said county of Sullivan, duly commissioned and sworn, and authorized by law to administer oaths and take acknowledgment of deeds; that the signature to said certificate, purporting to be his, is, in my belief, genuine, and that said instrument is in conformity with the laws of said State of New Hampshire.

In testimony whereof, I have hereunto set my hand and affixed the seal of said court this thirtieth day of October, A. D. 1863.

[L. S.] LYMAN J. BROOKS, *Clerk.*

In the matter of the application of Moses Marshall for extension of his patent, granted 11th December, 1849, and reissued April 24th, 1860, for improvements in looms for weaving figured fabrics.

Before the hon. the Commissioner of Patents.

The applicant has the honor to submit the following remarks, by way of argument, in support of his application:

The nature of the invention in question is briefly described in the beginning of his statement of receipts and expenditures, and no further description of it need be given here.

The invention possesses that radical and clearly-defined character which of itself will make most of the points in the case comparatively easy of determination.

Thus its novelty, on the contrary, must readily appear without embarrassment from nice questions of similarity or difference. The ingenuity involved in, and the amount of study and contrivance required for, its complete practical working out will be obvious from the character
524 of the problem which the applicant undertook to solve, no less than from the details of his solution of it given in the patent itself. The most striking utility of the invention, consisting in increased ease and rapidity of motion, is so plain a consequence of the nature of the thing done, as hardly to require demonstration in evidence. Upon these questions not much time need be spent.

Novelty.

Several witnesses, whose pursuits for many years have kept them in the way of knowing what kind of fancy looms have gone into use in this country, testify that, so far as their information goes, the applicant was the first to practise this mode of fancy weaving; namely, keeping the shed open, except so far as the course of the pattern required it to be changed. He himself swears, in his petition, that he still believes his invention to be original and new. And there is no reason to suppose that the examination in the Patent Office, following upon that which was made at the time of reissuing the patent in its present form, will reveal any matter of record or publication, anticipating the applicant's date of invention as shown upon the files.

Utility, value, and importance to the public.

Several witnesses testify to the increased speed of weaving due to the use of the applicant's invention. Mr. Campbell, in particular, who as overseer or section hand for several years in the Maverick Woollen Company's Mill, superintended the open-shed looms made by Mr. Crompton, under the Marshall patent, side by side with the close-shed looms of the same manufacturer, testifies that the former run to 85 picks per minute to 75 of the latter; and that too with superior ease to the loom. And he says that the open-shed looms produce from three to five yards per day per loom more than the close-shed looms.

He adds: "These goods (cheap military goods) are woven at a cost of two and a half to three cents a yard, making a saving of from ten to fifteen cents in the cost of weaving daily per loom, or from thirty to forty-
525 five dollars annual saving in the cost of weaving on each loom. These figures I believe to be below the fact. They are based upon the greater rapidity with which the looms can be advantageously worked in consequence of the reduced number of movements of the harnesses and warps." He also states that there is, with the same weight of yarns, decidedly less breakage of warps with the open-shed looms than with the tight-shed looms. Mr. Austin, who assisted to set up and superintend the working of the first Marshall loom in 1849, says that the gain in amount of production per day per loom from this saving of breakage of warps (owing to the reduced number and more favorable condition of the warps through which the lay beats up) was about one yard per day.

We may thus, upon the testimony of the two together, put the increase of production, from the use of the applicant's invention, at

five yards per day, without risk of exaggeration. And taking five cents per yard, the cost of weaving at the Burlington Mills in 1849, as the average cost of weaving ordinary goods on fancy looms, we have twenty-five cents per day, or seventy-five dollars per year, per loom, as the money saving in cost of weaving by reason of the applicant's improvements.

It further appears that the use of the open-shed improvement of Mr. Marshall produces a large saving in the longer wear of harnessess, owing to the lightening of their work in the looms. Messrs. Barrows and Campbell, speaking of the operation of the open-shed looms in the Maverick Company's Mill, as well as Messrs. Cook and Austin, speaking of the operation of the first Marshall loom at Burlington, refer to this element of money saving from their use; but the two last witnesses only state its value in figures. From their affidavits it appears that a set of harness would last as long again on the open-shed looms as on the close-shed looms—requiring to be placed on the latter about six times a year to about three times a year in the former. Taking the cost of a set of harness, as they state it, at five dollars, this would make a difference in the Burlington Company's Mill, for instance (keeping in regular use two hundred sets of harnesses to one hundred looms), of three thousand dollars, or thirty dollars per loom, annual saving in that particular.

526 It is readily acknowledged that these computations are to some extent conjectural, because of the fact that the first open-shed loom was in operation at Burlington a less time than that of the wear attributed to a set of harness in such a loom. The witnesses can only say that from what appeared during that space of time they believe the difference of wear of harnesses would have turned out to be as above stated. The Maverick Company witnesses made no observations of the results of the open-shed loom work in their mill in this particular, such as to enable them to give any statistics by which to try the accuracy of the judgment formed by the Burlington witnesses of what would have been the results, in this particular, of the working of the open-shed looms in their mill if long continued.

Allowing two sets of harnesses to a fancy loom (the average at Burlington), we should have, upon their showing, a saving of about thirty dollars a year on each loom in the matter of superior wear of harnesses on open-shed looms, and reducing this estimate one-half, in order to bring it as certainly as possible within the limits of accuracy, we have fifteen dollars a year per loom on this score to be added to the saving of seventy-five dollars a year per loom on the score of sure increase in rapidity of production, or ninety dollars annually for each loom saved, by a reasonably certain calculation, by the use of the open-shed loom; and this saving manifestly due to the peculiarities of the loom involved in the invention itself. And it is well to observe here that Mr. Barrows, an experienced fancy manufacturer, having recently had occasion to purchase looms for a new fancy mill of his own, has himself ordered the Marshall open-shed looms made by Mr. Crompton, though at a cost of twenty-five dollars more per loom than he would have had to pay for looms like them in other respects, but not embracing his open-shed operation.

It is now proper to inquire to what extent these advantages have been enjoyed thus far by the public, through the manufacturers of fancy goods. There have been at the Maverick Company's Mill twenty open-shed looms in use for four years, and eighteen in use for two years. There have been also in use for over two years one hundred in other mills in Massachusetts, made in violation of the Marshall patent; to

say nothing of the fifty to seventy-five of unlicensed manufacture,
527 and those ordered by Mr. Barrows, now making. Allowing ninety dollars a year as the amount of saving by the use of this invention per loom, we have over twenty-eight thousand dollars of benefit actually enjoyed from it by the public with the limited use, and the recent period of use, of the looms, which the evidence shows.

The reasons why the open-shed looms did not go sooner and more widely into use, will be referred to presently. It is sufficient, in completion of the present point of the argument to say that it appears every way reasonable to believe that the use of the open-shed fancy looms will be many times larger during the next seven years than it has been during the past fourteen; the commercial causes which for the first ten years of the life of the patent repressed almost altogether its profitable introduction being now removed, and a large and growing demand for those looms being manifested.

At the same time the Commissioner will observe that precisely because the invention has been used only at Burlington, for a few weeks fourteen years ago; at Dedham, by the Maverick Woollen Company for several years past, but without concert with the inventor, and without systematic observation of its working such as he would have provided for; and in other places (see Mr. Crompton's affidavit) by persons purchasing from an unlicensed manufacturer, themselves liable to suit, and consequently unavailable to him as witnesses, the applicant is without the ordinary opportunities of making such exact proof of value of the invention as ought generally to be furnished. Under which circumstances he may with the same propriety ask, as he does ask, the Commissioner to judge from the loom itself, and the nature of the object which the improvement was designed to, and unquestionably did, accomplish, whether the improvement must not necessarily have produced some such saving as the evidence which the applicant can command attributes to it.

Diligence of inventor.

Passing now to the history of the applicant's connection with the invention, the Commissioner will find a somewhat singular record
528 of difficulties opposing themselves to the commercial success of this inventor.

An experienced machinist in the employ of the Burlington Manufacturing Company, he contrived his new loom at that place in the year before his patent was granted, and obtained leave to have one built and put up in the company's mill. Mr. Cook, who was agent of the mill at that time, states that the loom accomplished what had long been desired in fancy weaving, and succeeded so completely that the mill would undoubtedly have been stocked with similar looms, but for its failure in the summer of that year, 1849. And his statement is confirmed by that of Mr. Austin, who assisted to set up and superintend the running of the loom.

The failure of the mill and breaking up of its operations would have destroyed at once all the practical advantage which Mr. Marshall had gained by his loom's success in the mill with reference to his profitable introduction of it elsewhere, even if his own circumstances had permitted him to proceed therewith. But he was himself thrown out of employment, and obliged to seek support for himself and his family in a strange place.

He removed to Lowell a few weeks afterwards, and, as appears by the affidavits of Messrs. Aldrich and Tyng, went immediately to work

upon the arrangements for obtaining his patent, a fact which not only shows him diligent at that time, but strongly tends to confirm the evidence above mentioned of the success of his first loom at Burlington; for without a distinct and important success there, he would not have proceeded with a costly application for a patent at the expense of his own slender means.

His patent was obtained 11th December, 1849, and while it was pending at Washington, he already had secured a second opportunity of getting his invention in use, and the Commissioner is desired upon this point to read critically the affidavit of Mr. John Harding, in which all the circumstances of the construction and use and disuse of this second Marshall loom are detailed, It will be seen that it was introduced into the Middlesex Mills under particularly unfavorable circumstances, not only because the patentee was obliged to content himself with an
529 unsuitable loom-frame to which to apply his improvement, but also because its introduction into the mill was regarded, upon the whole, by persons connected with the mill, with disfavor, apart from its merits, because the change in the market, which will be presently more particularly referred to, by which the demand for this class of looms was materially curtailed, had already commenced; and also because the project of a rival loom of this class, which some years afterwards ripened into the production of the Thomas looms, so-called, now made in considerable numbers in violation of Mr. Marshall's patent, was already started by persons holding influential positions in that mill. Notwithstanding this adverse feeling, Mr. Harding says that in the considerable discussion of the loom which took place in the mill, he heard no objection made to it, and that although the trial which it obtained there was not a fair one, it showed itself to possess important advantages, and, so far as its principle of operation was concerned, was entirely successful. Mr. Marshall was at this time, as he has been ever since, a man of limited means, dependent upon his daily wages for the support of himself and his family; and had the conditions of the enterprise of getting his new loom introduced into fancy mills been ordinarily favorable in the years succeeding the use of his loom in the Middlesex Mill, it would have been hardly in his power, poor and unknown as he was, to have accomplished its introduction to advantage, if at all.

But there occurred at this time one of those changes in this woollen goods market such as no sagacity can foresee, and no means or industry contend with. In 1849, or 1850, as appears by the affidavits of Mr. Cooke and Mr. Austin, the demand for fancy goods, that is to say, moderately figured woollen goods for which looms of the class embracing Mr. Marshall's improvements are especially adapted, declined; and doeskins and other plain-faced goods, which could be as advantageously made upon other and cheaper looms, came into fashion. The market so continued until 1856 or 1857, when the demand for fancy goods revived, and looms like Mr. Marshall's again became highly desirable; and so the market has been ever since. But the Commissioner will recollect that in 1857 the manufacturing business of the whole country,
530 in common with its other industry, suffered a severe depression. The mills in New England had more looms on hand than they were able profitably to use for some time after this year, and it was therefore practicably impossible for Mr. Marshall in 1857, or for several years afterwards, to force his new loom into use in the mills, costing, as they did, a somewhat larger amount to build than the looms already in use, which were abundant in number and sufficient for the purposes of the moderate manufacturing business which the mills of New England during this period were alone in a condition to maintain.

During the period from 1850 to 1859, while at work at his trade in Lowell, Mr. Marshall was on the watch for opportunities to introduce his loom still farther into use, as testified in his statement, and as may be gathered from the fact that in 1856 or 1857, when the demands for fancy goods began to revive, he went to see Mr. Austin to consult him as to the ways and means of taking advantage of that turn in the market. Mr. Austin, however, advised him that there was no prospect of his success, owing to the then condition of business. And the evidence makes it plain that neither then, nor at any other time between 1850 and 1859, was there any such demand for improved fancy looms as would admit of Mr. Marshall's getting his own farther introduced. (See Aldrich's affidavit as to Marshall's constant attention to his new loom, and efforts to enlist manufacturers in its introduction in 1849 and 1850.) In 1859, the patent having but a few years to run and seeing no prospect, with any means or influence which he could command, of further introducing his improved looms, Mr. Marshall became satisfied that the best course which he could pursue was to put his patent into the hands of some established loom builder, who would be in a situation to take advantage of whatever opportunity might arise, and by manufacturing his improved looms in considerable number if called for, get them economically and favorably into use.

He accordingly assigned his patent to Mr. George Crompton, then and now one of the leading fancy loom builders of this country. It cannot be doubted that this was the most prudent course for Mr. Marshall to take. The consideration which he received from Mr. Crompton
531 for the unexpired term of his patent was, in view of the actual value of the invention, certainly extremely small; but in view of the fact that, from circumstances already related, the loom had not up to that time become at all conspicuous before manufacturers, was radically new in its operation, cost more in the first instance than the Crompton close-shed looms, then generally in use, and the whole enterprise was, commercially speaking, in the nature of an experiment, he could hardly expect to obtain from Mr. Crompton, then busy with the manufacture of his own looms at a profit, any better terms. The real consideration which Mr. Marshall obtained from the conveyance of the unexpired term of his patent to Mr. Crompton, and which was a consideration that he could obtain in no other way, was that during the three or four years which the patent had yet to run, his looms might, by the aid of Mr. Crompton's capital and influence, get a reputation and a standing among fancy manufacturers, so that when Mr. Marshall's patent should be extended he would be in a condition to reap the profits of his invention from which the unfortunate course of events during the original term had excluded him. That such was his policy in making his arrangement with Mr. Crompton, is shown by the emphatic language which Mr. Marshall uses in reserving to himself the interest under a possible extension of his patent. After assigning the original term to Mr. Crompton, he proceeds to say: "Meaning and intending hereby to sell, assign, and convey my interest in said patent right for and during the unexpired term for which said letters patent were issued, and reserving hereby to myself and my heirs, executors, and legal representatives, the full and perfect right to said improvement and letters patent that may hereafter be granted or obtained for any and all extension of said letters patent beyond the time for which letters patent have been granted, to be enjoyed and held by me without interference from the said Crompton, for such time as said patent may be extended."

The result of the sale to Mr. Crompton completely justified the view

Mr. Marshall had taken. As the fancy woollen manufacture of the country regained its former activity, looms of Mr. Marshall's improved construction came into demand, and Mr. Marshall is able to show
532 to the Commissioner the evidence of two lots of looms embracing his invention now in course of construction; one lot by Mr. Crompton to stock a fancy mill erecting by Mr. Barrows, and another lot of fifty to one hundred looms which are making in violation of Mr. Marshall's rights. It should also be noticed that within two or three years the manufacture of fancy cottons, which, previously to the time of Mr. Marshall's assignment to Mr. Crompton, was scarcely known in this country, has been so developed as to require the construction of one hundred cotton fancy looms. These have been also made in violation of Mr. Marshall's patent. The parties who have committed these infringements upon his rights have been notified of the fact, and Mr. Marshall only awaits the decision of the Commissioner in his favor, upon this application, to take legal proceedings with a view to protect his invention from piracy in this direction for the future. (See also on this point Mr. Crompton's affidavit.)

And here it seems only proper to remark that, if such decision shall be adverse to the application, Mr. Marshall will be deprived of the enjoyment of his invention for some years to come, which are likely to be more profitable in its use than all the previous fourteen were or could have been made; and this by the mere misfortune of being a grantee under the old patent law, instead of under that which was enacted a year or two since; for by the latter he would be a patentee for seventeen years, and, during the three additional years so secured to him, would have a fair opportunity of reaping a moderate proportion of the profits to which his invention entitles him.

It is submitted as a just view of the merits of this application, in view of the fact that Mr. Marshall failed to realize what he was entitled to during the original term merely by the unfortunate occurrence of circumstances which have only recently ceased to operate, that the policy of the law, as indicated by the recent legislation referred to, regards patentees generally as entitled to a term of seventeen years, and that unless there appears in the case, as it is submitted there does not appear, any circumstance which countervails this policy in Mr. Marshall's instance, he is for these reasons entitled to the extension he asks.

533 *Account of receipts and expenditures.*

Mr. Marshall's statement of the receipts and expenditures, under the original term, is as full and as much in detail as the nature of the case admits. The only item which is at all conjectural in its character, viz., the cost of the Patent Office model, is affirmed by the affidavits of Mr. Aldrich and Mr. Tyng to be reasonable in itself. The account shows an actual pecuniary loss of $266 02.

Upon the whole case it is submitted that here is an invention of indisputable novelty, ingenuity, and value to the fancy manufacture of the country, and that the utter failure of Mr. Marshall to obtain from the enjoyment of the original term of his patent any just compensation for his invention, has been owing to circumstances entirely beyond his control, consisting mainly in such vicissitudes of the market and of the general business of the country as opposed embarrassments of an unusual character, and in themselves entirely insuperable, to the profitable introduction of his loom into use; also, that if he shall now receive

an extension of the term of his patent, such as the history of his connection with it and the declared policy of the law show him entitled to receive, he has every reason to expect that, to a considerable extent, he will be able to make up the loss he was compelled to sustain under his original term.

Respectfully submitted by—

CAUSTEN BROWNE,
Of Counsel.

UNITED STATES PATENT OFFICE,
November 25, 1863.

SIR: In the matter of the application of Moses Marshall for an extension of his patent No. 6939, granted December 11, 1849, and reissued April 24, 1860, to himself as assignor to George Crompton, for improvements in looms, I have the honor to make the following report:

534 The nature of the invention protected by this patent cannot, perhaps, be more succinctly and clearly stated than in the language of the patent itself, in which it is declared that the "invention relates to improvements in that class of looms for weaving figured and fancy fabrics in which a series of leaves of heddles are operated by jacks elevated and depressed by a lifter and depresser, as their position is determined to suit the design to be woven, by a pattern chain, or any of the well-known equivalent devices for determining the pattern. And the object of the first part of the invention is to avoid moving any of the leaves of heddles which are not required to be moved for the production of the design during any part of the operation, so that the movement of the heddles and warps, in closing and opening the sheds, shall be limited to such of the warps as are at the time actually required for the production of the design or face of the fabric. And to this end this part of the said invention consists in combining with the series of jacks that lift and depress the leaves of heddles with the lifter and depresser for lifting and depressing the jacks, and with a pattern chain or other equivalent device for placing the jacks in position to be lifted or depressed, a mechanism for holding any of the jacks either in the elevated or depressed position, when the pattern chain or other equivalent device does not indicate that they are required to be shifted for the production of the fabric that is at the time being woven.

And the second part of the invention, which relates to the method of lifting and depressing the jacks by what are known as lifters and depressers, consists in imparting an irregular motion to the lifters and depressers by means of eccentric cog-gearing, so timed, relatively to the motions of the loom, that the lifter and depresser shall move with the greatest velocity at the time the warps are crossing to close a shed and open another, the period of so closing a shed being at or about the time the lay beats up the weft thread, so that the warps shall close upon the weft thread before it is relieved by the back movement of the lay.

In this way a much closer fabric can be woven than by crossing the warps as the lay returns.

535 To effect the purpose so indicated, it is important that the heddles should be operated rapidly at the time of beating up the weft thread, as the weft thread should be forced home before the shed closes, and the crossing of the warps should take place during the instant of time that the lay stops to return.

Novelty.—A careful examination into the state of the art prior to the granting of the original patent has not disclosed to me anything which negatives the novelty of the invention at that period. The solemn and deliberate action of the office also, at the time of its reissue in 1860, affords another expression of its opinion upon the same point.

And, in addition, the testimony of several witnesses of the most enlarged experience in practical weaving in some of the extensive mills in New England is to the effect that they never heard of "open-shed" looms until they became acquainted with the loom of Mr. Marshall, which is the subject of this patent.

Utility.—Its utility, although quite apparent from a study of the patent, is very fully testified to by a number of witnesses, all of whom, from their occupations and familiarity with this class of machines, seem peculiarly qualified to speak advisedly; most of them having also had special opportunities to observe the practical working of looms constructed upon Marshall's plan, as patented. A summary of its advantages, derived from the testimony, may be briefly stated as follows: That by reducing the number of warps to be moved at each operation of the loom, to the comparatively small number which the course of the pattern requires to be shifted, the average work of the loom is much lightened, and the loom enabled to run at a considerable higher speed; there is less wear to the harness, and also to the reeds; less chafing of the warp threads, and consequently less breakage; the character of the woven goods is better, owing to the closer lay of the filling, giving a firmer texture and superior surface; very few, comparatively, of the warp threads being at the centre line of the shed when the lathe beats up (all of them in the close-shed looms lying nearly on the same level and in a slack state), the difficulty arising from the tendency of the mass of slack warp threads to kink and break by the beating up of the
536 lay is much diminished; and also there is, as consequential upon some of these advantages, less frequent necessity for stopping the loom.

I see no reason to dissent from the above as indicating the reasonable results calculated to flow from this invention.

Value and importance.—The witnesses produced to this point are Messrs. Barrows, for 30 years practically acquainted with fancy weaving as agent of the Maverick Mills, and an overseer; Campbell, a weaver for 17 years, and overseer of the Maverick Mills; Crompton, for 12 years a fancy loom-builder, and owner of the original term of the patent under consideration; Cook, formerly agent of the Burlington Mills at the period when Marshall's first machine was put up and tried there, and for 30 years connected with the woollen manufacture in this country; Austin, a practical weaver, as man and boy, for 50 years—since 1836 in this country, and prior thereto in England; and Harding, a weaver for 25 years, and overseer of the weaving-room at the Middlesex Mills, Lowell, at the time Marshall's loom was put up and worked there.

Cook, whose affidavit is very full and circumstantial, and who appears to have had every opportunity to judge of the practical working qualities of Marshall's improvements, testifies that in the early part of 1849, Marshall (then employed at the Burlington Mills, of which affiant was then the agent) produced his open-shed loom, as represented in his present patent. He gives a minute review of the objections to close-shed looms which they had been previously using, confirming, in this respect, the statement of other witnesses (Barrows, Crompton, Campbell, and Austin); and states in detail the advantages of Marshall's loom, substantially in accordance with the summary above given. He also stated that this

loom, in which no warp threads were moved till the course of the pattern required it to appear on the other part, was a great improvement in this respect. He adds that this loom ran but a short time, as the mill failed a few weeks after it was introduced; and, after assisting to work up the stock under direction of the assignees, it was sold with the company's property. This, witness says, was Marshall's first loom, and it was a decided success, though it worked less smoothly than might
537 be expected of those made afterwards; it made better faced goods, and effected a great saving in wear and tear. Judging from what was done at Burlington, a set of harness with Marshall's open shed would last as long again as in the old close-shed looms. In fancy looms in New England there are about twenty-five harnesses to a set of cards; in our fancy loom at Burlington we used from six to not more than twelve sets of cards; this is probably not $\frac{1}{100}$ (one hundredth) part of the fancy weaving in New England to which the open-shed system is applicable. But for the company's failure in 1849, Cook thinks they would have introduced Marshall's looms throughout the mill, as they were so successful and answered so completely, accomplishing results long sought for among fancy manufacturers.

Austin, who says he wove the first piece of fancy goods woven in America, and was overseer in said Burlington Mills, and has since set up and started new fancy looms in different mills, testifies that he recollects Marshall's open-shed loom put up in 1849 in the above mill; that he assisted in putting up and starting it, and, with a man under him, did all the weaving that was done on it before the company's failure; that although this was the first of these looms that was built, and worked to a disadvantage, yet it worked remarkably well; the principle of its operation was perfectly successful; he concurs with Cook and others in the enumeration of the advantages due to Marshall's improvements, as to the economy of working, reduction of wear, less frequency of stopping, superiority of the woven product, increased speed of weaving, and consequent increased production. He concludes this portion of his evidence by adding that Marshall's invention brought about an improved operation long desired, and was a very great advantage to the fancy manufacture.

But for the company's failure, he thinks the mill, which usually ran about one hundred fancy looms, would undoubtedly have been stocked altogether with these looms, herein indorsing the opinion of Cook.

Harding, whose acquaintance with Marshall began about the time the latter came to Lowell, in 1849 (subsequent to the failure of the Burlington Mills), and who was at that time overseer in the weaving-room
538 of the Middlesex Mills at Lowell, in which Marshall's second loom, containing his improvements, was set up and operated, testifies that this loom was constructed by adapting his improvements to an old loom belonging to the company; that he had personal knowledge of its construction and operation; that the loom was, however, in operation but a short time, during which it showed itself to possess important advantages by reason of its keeping an open-shed—"that is, keeping the warp threads up until the pattern required them to go to the under side of the shed, and vice versa." So far as its principles were concerned, it was entirely successful. But the frame of the loom which had been selected for it, and which the company provided him for the purpose, proved to be too light, and several parts of it (independent entirely of Marshall's improvements) broke down in the operation of the loom and had to be repaired, so that no satisfactory test of the amount of advantage due to Marshall's improvements was obtained. Never heard any

objection made to its use in the mill, except the weakness of the old frame. The trial given was too short to do it justice.

Campbell, overseer of Maverick Mills, which has in use 38 of these looms, says he has observed their working alongside of Crompton's tight-shed looms; they run 85 picks against 75 of Crompton's, and are more easily moved at those rates; that there is a difference of from 3 to 5 yards a day (in weaving military goods), in favor of the open-sheds, saving annually each loom about $30 to $45 in the cost of weaving; he asserts that he thinks this an under estimate. After detailing the several advantages, according in this regard with the testimony of Cook and others, he affirms that these looms are better than the close-shed looms, even though there were no gain in the amount of cloth produced. Both he and Barrows, whose evidence will be presently alluded to, agree that, in all their experience, they never heard of an open-shed loom before this of Marshall.

Cromptom, for 12 years a fancy loom builder, agrees with Campbell as to the merits of this loom, and thinks Campbell's statement "fairly and moderately stated." He states that there are 100 cotton looms for open sheds that he knows of, which have been in use two years in Massachusetts, and from 50 to 100 woollen fancy looms now building
539 (but not of his make) with open sheds, as in Marshall's patent, and with his combination of devices substantially, but operating in the same way, and producing the same result; that he has notified the users of these looms of their infringement of this patent (which he at present owns); but, upon reflection, has not thought it worth while to commence suit, because the expenses of litigation, which the interest of these infringers would justify them in incurring, made it not worth while for him to sue them for the damages which he could recover for the short time remaining of the term of the patent. To this latter statement, it seems proper to remark that his present right to recover would be for past, not prospective, infringements.

He further states that he has every reason to expect a large and increasing demand for the open-shed looms for some years to come, and that the slight demand for them, and Marshall's failure to introduce them prior to 1859, was due to circumstances independent of the value of the invention, and entirely beyond his (Marshall's) control.

The reasons assigned, by the witnesses, for this failure to introduce them until so late a period will be collated under the head of "Due Diligence."

Barrows says that, at the Maverick Mills, they have used the old and the modern Crompton looms, and 38 open-shed looms purchased since 1859, and after sufficient testing them "to show their decided superiority," they purchased 20 more, built by Crompton (Marshall's assignee), and under Marshall's patent. After detailing the several advantages, as hereinbefore stated, he alleges that the fancy goods woven on these looms are worth more in the market, by reason of these advantages growing directly out of the open-shed mode of operation.

He says he knows of no reason why they should not go rapidly into use to a much larger extent than heretofore; "their superiority for practical purposes being unquestionable, when fairly tried."

By way of a forcible demonstration of his confidence in the value and importance of this loom, he adds that he is now engaged in fitting up a fancy mill of his own at Dedham, and has ordered from Mr. Cromption these open-shed looms, though at a cost of $25 per loom more
540 than he should pay for tight-shed looms, similar in other respects.

None of the witnesses have stated whether or not they have any

interest in the question of the extension of this patent. In the assignment by Marshall to Crompton (Record of Assignments, Liber I[5], page 363), the inventor has carefully guarded his rights under a prospective extension, by assigning only the unexpired term, and expressly reserving to himself the right to said improvement and letters patent that may be granted, "for any and all extension of said letters patent beyond the term for which letters patent may have been granted," to be enjoyed and held by him, "without interference from the said Crompton, for such time as said patent may be extended."

Remuneration.—Upon this question the sworn statement of the inventor is to the effect that he spent, as he believes, not less than eight months of pretty constant study and labor upon the invention, and getting it into use at Burlington. It does not appear that he received any return for the few weeks his loom was running there; nor that he realized anything from the Middlesex Company. His entire receipts from the beginning until now appear, by his schedule below, to have been $300 only; that being the amount of the purchase-money paid him by Crompton for the assignment. His expenditures were made up of the following items:

Paid for building Patent Office model, materials, extra help, shop-rent, &c	$150 00
Expenses of obtaining patent	183 43
Cost of patterns for model	45 00
Cost of loom for Middlesex Company	178 84
Two trips to get castings	8 75
	$566 02
Deduct receipts	300 00
Showing an actual loss to Marshall of	$266 02

541 It is due to the inventor to say that in this statement he has made no charge for his own time and services in and about the experimenting with and perfecting his invention. The almost nominal sum which he received for his patent seems at the first glance, in view of the sworn importance of the invention, so utterly inadequate as to arrest attention. But, upon a review of the evidence, the fact of his want of means, his lack of facilities to more rapidly introduce his machine, the decline in the demand for the class of goods produced by it, his persistently retaining the control of his patent for about 10 years, and only disposing of it into such hands as afforded a reasonable hope of its being introduced into mills, without expense to himself, as rapidly as the wants of the manufacturing community might demand, and but few of whom had yet tried it. All these circumstances seem to furnish a satisfactory explanation of his accepting so small a sum.

The sequel, as the evidence discloses, shows that in Crompton's hands the invention was now industriously put into the market, the trade in the product of such looms having revived.

Tyng and Aldrich confirm the applicant's statement as to devotion of time to his invention; they agreeing that, from 4th of July to about Christmas, 1849, his whole time and attention appear to be given to this improvement, getting a model of it made for the Patent Office, and trying in various ways to introduce it into use. The cost of the model ($150), as to the expensiveness of which they express an opinion, does not, upon inspection, appear to be other than a fair price; Aldrich thinks it cost not unlikely as much as a full-sized loom.

Both these witnesses state that Marshall at that time appeared to be not a man of means, but dependent upon his wages as a mechanic, and had a wife and, they think, five children to support; and that his circumstances have remained so ever since, so far as they can judge from frequent intercourse with him as a townsman and neighbor.

Cook testifies to Marshall's great labor and study on his loom in the Middlesex Mill, and says he was almost constantly occupied the
542 greater part of the year before the company failed, and thinks nothing but such failure prevented his realizing a handsome profit.

Due diligence.—The evidence relating to the diligence of Marshall in introducing his invention into general use has been, unavoidably, more or less incidentally presented, in considering the other preceding questions.

In addition, Tyng testifies that Marshall, from July, 1849, to the end of the year, paid close attention to getting his loom introduced by manufacturers, and that witness himself, at Marshall's request, brought several persons to examine the loom, who, he thought, were likely to be of service to him in getting the invention introduced.

And Austin swears that he knows that Marshall worked diligently in getting his loom into operation at Burlington. As to the period of time between his leaving Burlington, and the year 1856 or 1857, he cannot say how much time and attention he gave to its introduction, but from the fact that, during that time and afterwards, the demand for fancy goods was almost entirely suspended (doeskins and fabrics of that class taking their place), he is satisfied that it was out of Marshall's power to get his looms introduced by any exertions he could make.

In 1856 or 1857 he came to witness, and opened the subject of getting his loom pattern introduced, who gave him his opinion that the market was not in such a state that it would be practicable for him to do so.

Harding also states that there was considerable objection made beforehand to permitting the Marshall loom to be introduced into the Middlesex Mills at Lowell, on the ground that the manufacture of fancy goods was getting to be very light about that time, and cam looms, well enough adapted to weave doeskins and similar fabrics, would come much cheaper.

This disinclination of this company to more extensively try the Marshall loom, may perhaps have been increased from the other fact stated by this witness, viz., that the subject of an open-shed loom had been already talked about in the Middlesex Mill; particularly Mr. Ev-
543 erett, the designer of the company, had spoken of getting up one himself—Mr. Everett subsequently becoming connected with a Mr. Thomas, a patentee of an open-shed loom.

It will be observed that the array of witnesses offered embraces those who operated or tested the capacity of the invention, with the exception of those four establishments alleged to be using it without license, and upon whom it could not be expected the inventor would call for testimony in his behalf; but there appears to be no opposition on file from them or from any other persons.

It seems proper to remark that none of the witnesses state whether or not they have any interest in this application; at the same time there does not appear to be anything in the evidence which indicate such interest.

All of which is respectfully submitted

JOHN J. HALSTED,
Acting Examiner.

Hon. D. P. HOLLOWAY, *Commissioner of Patents.*

UNITED STATES PATENT OFFICE, *Dec.* 8, 1863.

The report of the examiner is approved, and it is hereby ordered that said patent granted to Moses Marshall, bearing date Dec. 11th, 1849, be extended for the term of seven years from and after the 11th day of Dec., 1863.

D. P. HOLLOWAY, *Commissioner.*

544 *Memorandum of fee paid at U. S. Patent Office.*

Inventor, Moses Marshall.—Invention, extension loom.—Date of payment, 10th December, 1863.—Fee, $50, balance extension fee.—Solicitor, A. B. Stoughton.

In the matter of the application of Moses Marshall for extension of his patent dated 11th December, 1849, reissued 24th April, 1860, for improvements in fancy looms.

Before the Commissioner of Patents:

Mr. James Cook, Warren Aldrich, and Levi B. Tyng, all of Lowell, Massachusetts, and of lawful age, do severally swear, each, that he has no interest whatsoever in the above application for extension.

JAMES COOK.
WARREN ALDRICH.
LEVI B. TYNG.

545 NOVEMBER 30, 1863.

COMMONWEALTH OF MASSACHUSETTS, *Middlesex, ss:*

Then personally appeared the above-named James Cook, Warren Aldrich, and Levi B. Tyng, and severally made solemn oath to the truth of the foregoing certificate by them subscribed.

Before me,

EDWIN A. ALGER,
Justice of the Peace.

In the matter of the application of Moses Marshall for extension of his patent, dated 11th December, 1849, reissued 24th April, 1860, for improvements in fancy looms.

Before the Commissioner of Patents:

Isaac Austin, of Claremont, New Hampshire, and of lawful age, being duly sworn, says:

I am not interested in any way whatever in this application for extension.

ISAAC AUSTIN.

NOV. 30, 1863.

STATE OF NEW HAMPSHIRE, *Sullivan, ss:*

Personally appeared Isaac Austin, and made solemn oath that the above affidavit by him subscribed is true.

Before me,

IRA COLBY, JR.,
Justice of the Peace.

In the matter of the application of Moses Marshall for extension of his patent, dated 11th December, 1849, reissued 24th April, 1860, for improvements in fancy looms.

546 Before the Commissioner of Patents:

John Harding, of lawful age, being duly sworn, says:

I reside in Harrisville, Cheshire Co., N. H. I have no interest of any kind whatever in this application for extension.

JOHN HARDING.

STATE OF NEW HAMPSHIRE, *Cheshire, ss:*

Personally appeared the above-subscribed John Harding, and made oath that the above certificate, by him subscribed, is true.

M. W. HARRIS,
Justice of the Peace.

No. ——. Extension $\frac{81}{235}$

Moses Marshall,
Of Lowell,
County of
State of Massachusetts.
Fancy looms.
Rec'd August 14, 1863.
Petition " " "
Affidavit.
Specification.
Drawing.
Model.
Cert. dep.
Cash, $50. Aug. 14, 1863.
Add'l fee cert.
1 " " cash, $50. Dec'r 10, '63.
547 Examined.
2 issue extended.
3 patented December 8, 1863, 186.

Recorded vol. 1, page 509.
Circular, Dec. 10, '63.
Patented Dec. 11, 1849.
Hearing Nov. 23, 1863.
Closing test'y Nov. 9, 1863.

A. B. STOUGHTON, *Present.*

548 *Complainant's Exhibit C.*

United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of this office of the specification and drawing in re the letters patent granted Henry Bachofner, Oct. 30, 1849, No. 6823.

In testimony whereof, I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed, this sixth day of August, in the year of our Lord one thousand eight hundred and sixty-six, and of the independence of the Uited Stnates the ninety-first.

[L. S.] T. C. THEAKER.

Henry Bachofner, Springfield, Mass.—Letters patent No. 6823, dated October 30, 1849.

To all to whom these presents shall come:

Be it known that I, Henry Bachofner, of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new
549 and useful improvements in power looms for weaving figured fabrics, and that the following is a full, clear, and exact description of the principle or character which distinguishes therefrom all other things before known, and of the usual manner of making, modifying, and using the same, reference being had to the accompanying drawing which forms a part thereof, in which Figure 1 is a side elevation, Figure 2, is a section on line * * Figure 1.

The nature of my improvement consists in the construction and arrangement of parts for working the harness, and their connection with the moving power, by which I simplify the loom, and save a considerable amount of the power required to drive looms as heretofore constructed.

The construction is as follows: The loom frame (*a a*) is in all essential particulars like those of ordinary looms, reserving only such minor modifications as are required by the new parts of my loom. The harnesses are connected with frame (*b*), which consist of a lower stem (b^1) at the centre of the breadth of the frame, and supported in a stationary guide (*c*); from the top of this stem the frame branches out towards the sides of the loom, and then rises perpendicular upward to a proper height, and terminates in a curved end that turns inward to a horizontal line. Holes (*d*) are made in the ends of this frame, and others (*d*) perpendicularly below them, for the purpose of attaching the harness to. There are as many of these frames as there are leaves of harness; their perpendicular sides are steadied and guided by fixtures (*i*) attached to the frame of the loom. To the stem (*b*) are connected horizontal levers or marches (*e*) that extend out a little beyond the side of the loom frame, where they connect with uprights (*f*), on each of which there are two notches; one on the outside for raising the uprights by, the other on the inside, next to the frame, for depressing them. On each side of the uprights there is a frame ($g\ g^1$) that vibrates up and down, composed of two horizontal arms each, connected by a perpendicular; the perpendiculars and lower arms of these frames slide up and down in proper bearings (*h i*) attached to the loom frame. The outside frame (*g*) is connected by a link (*k*) with the near end of a rocker (*l*) sit-
550 uated just below, and turned on a stud (l^1) in the frame; the inside frame (*g*) is connected by a similar link (k^1) with the front end of said rocker, the fulcrum being between them, so that, as the rocker is turned, it causes one of the frames (*g*) to rise, and the other to fall. Each time the outside frame rises, its upper arm catches the hooks of all the uprights that are not removed out of its way, and carries them up with it, thus depressing all that portion of the harness connected with them; but when any of the uprights are pushed back, in a manner to be presently explained, they come in contact with the descending arm of the inside frame and are depressed, causing the corresponding leaves of the harness to rise.

The apparatus for shifting the uprights back consists of an ordinary Jacquard prism or cylinder (*m*), connected with the lower arm of the inner frame (g^1) by means of its supports (*m*), with which it rises and falls; at a proper distance above this cylinder, on a stationary bar (*o*), there is a series of levers or fingers (*p*), one arm of which rests on the bar, and

the other stands vertically. These fingers are as many in number as the uprights (*f*), one opposite each of them. Under the horizontal arms of these fingers are pins (*q*) that project down through the bar (*o*), so that when the cylinder (*m*) rises they will enter a series of corresponding holes therein; if, instead of a hole on this cylinder, a blank be presented, by means of the ordinary cards or otherwise, the pin (*q*) will be found upward, and with it the horizontal arm of the finger lever (*p*), causing the vertical arm to bear the upright (*f*) over so that its inside notch will catch on the arm of the rear frame (g^1), and be depressed by it, as before named. To the bar (*o*) there is a hook (*r*) appended, that projects down to the Jacquard cylinder, and turns it, as it descends, in a manner similar to the similar fixtures in ordinary Jacquards. The rocker (*l*) has a long arm (*s*) attached to it, that extends back horizontally, and the near end is connected with the crank-shaft (*t*) by means of the rod (*s*); this rod is connected with the crank-shaft by means of an adjustable crank, shown more clearly in Fig. 3, and in the modification thereof. Fig. 4 consists of an arm (*u*) extending out from the shaft, and having a slot in it, into which a stud is adjusted. At the desired distance from the shaft near the outer end of the stud, there is a toothed circu-
551 lar plate (u^1), and over it there is an arm (u^2) fastened with a tooth on its inner face, that fits into one of the notches on said plate, so as to fasten it in any position. This arm (u^2) is made with a slot, into which an adjustable wrist (u^3) fits, to which the rod (s^1) is connected. This adjustable crank may be modified by making a concentric slot in the disk instead of the notches, which will be fully understood by inspecting the Figures 3 and 4; by it the crank pin or wrist can be placed in any desired position.

The other parts of the loom may be of the ordinary character, or more or less modified to meet the requirements of the manufacturers.

Having thus fully described my improved loom, what I claim thereon as new, and for which I desire to secure letters patent, is—

First. The combination of the Jacquard cylinder with the depressing frame and fingers for the purpose of working the uprights (*f*) thereby through the medium of the fingers, as herein set forth.

Secondly. I claim the combination of the lifting and depressing frames with the crank shaft, by means of a rock shaft connected with said frames by connecting rods, and worked by the crank shaft, with which it is connected by a rod for that purpose.

Third. I claim the frames for suspending and carrying the harness, in combination with the marches, and the apparatus for working the same, as above specified.

Fourth. I claim the combination of the hooks for lifting and depressing, with the marches and harness frames, without the aid of cords, as herein set forth.

Fifth. I claim the construction and application of the adjustable crank, by which I effect an adjustment in all directions in a simple and convenient manner.

HENRY BACHOFNER.

Witnesses:
J. J. GREENOUGH.
M. GREENOUGH.

552 *Respondents' Exhibit No. 6.*

United States Patent Office to all persons to whom these presents shall come, greeting:

This is to certify that the annexed is a true copy from the records of

this office of the letters patent granted George Crompton, April 27th, 1858, No. 20044, also the correspondence from files. In testimony whereof, I, T. C. Theaker, Commissioner of Patents, have caused the seal of the Patent Office to be hereunto affixed this twenty-first day of July, in the year of our Lord one thousand eight hundred and sixty-six, and of the independence of the United States the ninety-first.

T. C. THEAKER.

No. 20044.

The United States of America to all to whom these letters patent shall come:

Whereas George Crompton, of Worcester, Mass., has alleged that he has invented a new and useful improvement in looms, which he states has not been known or used before his application; has made oath
553 that he is a citizen of the United States, that he does verily believe that he is the original and first inventor or discoverer of the said improvement, and that the same hath not, to the best of his knowledge and belief, been previously known or used; has paid into the treasury of the United States the sum of thirty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant, according to law, to the said George Crompton, his heirs, administrators, or assigns, for the term of fourteen years from the twenty-seventh day of April, one thousand eight hundred and fifty-eight, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said improvement, a description whereof is given in the words of the said George Crompton, in the schedule hereunto annexed, and is made part of these presents.

In testimony whereof, I have caused these letters to be made patent, and the seal of the Patent Office has been hereunto affixed.

Given under my hand, at the city of Washington, this twenty-seventh day of April, in the year of our Lord one thousand eight hundred
[L. S.] and fifty-eight, and of the independence of the United States of America the eighty-second.

JACOB THOMPSON,
Secretary of the Interior.

Countersigned and sealed with the seal of the Patent Office.

J. HOLT,
Commissioner of Patents.

554 *The schedule referred to in these letters patent, and making part of the same.*

To all whom it may concern:

Be it known that I, George Crompton, of Worcester, in the State of Massachusetts, have invented certain new and useful improvements in power looms, for weaving twilled and figured fabrics; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings making part of this specification, in which—

Fig. 1 is a side elevation of the figuring apparatus of a loom without the weaving parts, which are to be of the usual construction.

Fig. 2, a vertical section taken at the line A *a* of Figure 1; and

Fig. 3, another vertical section taken at the line B b of Figure 1.

The same letters indicate like parts in all the figures.

In what is known as the Crompton loom, patented to William Crompton on the 25th day of November, 1837, the horizontal levers at top, which operate the series of leaves of heddles, are provided with what are termed jacks, suspended to their outer ends, and these jacks are thrown into position by the pattern chain or cylinder, so as to be operated by a lifter and a depresser, at each operation a portion of them being lifted, and all the others depressed to open the shed in accordance with the desired figure to be produced, as determined by the pattern chain or cylinder. The selection of the jacks, which are to be lifted, from those which are to be depressed in forming the next shed, is effected while the shed is closed, and hence, at each operation all the jacks, levers, and heddles are operated. Now, in most, if not in all designs or patterns, many of the warp threads are required to be in the upper, and others in the lower shed, during two or more throws of the shuttle, and hence it follows that the lifting and depressing of the heddles which control these warps at the forming of each shed, when the pattern does not require it, is a wasteful expenditure of power, and an injury to the warp threads and to the machinery, which waste and wear and tear I avoid by my said invention, which consists in combining with the series of
555 jacks suspended to the heddle levers, and operated by a lifter and a depresser, when placed in position by a pattern chain or cylinder, two vibrating bars acting on hooks or projections on the said jacks, after the pattern chain or cylinder has effected the selection for the succeeding shed to hold in place, before the closing of the shed, such of them as are required to be in the same position for the next succeeding shed.

And my said invention also consists in combining with the said vibrating bar, operating on the jacks, as before stated, a vibrating holding bar, which acts on the heddle levers to hold them in their elevated and depressed positions, while the vibrating bars for holding the jacks liberate the jacks, that they may be acted upon by the pattern chain or cylinder, to place them in position for the next shed.

In the accompanying drawings, (a) represents the frame of a loom, which may be of any suitable construction, and which is to be provided with the mechanism usually required in a power loom. The usual levers of heddles required in a loom for weaving twills or fancy fabrics are not represented, as they are well known to weavers, but instead I have represented heddles (b), with warp threads (c) passing through the mails, as sufficient to indicate the action.

The heddles are suspended between the inner ends of two sets of heddle levers (d) and (e), one set at top and the other at bottom, and each set vibrating on a fulcrum rod (f).

The upper set of levers (d) are wedge-formed at their outer ends, as at (g) (see Figure 2), for a purpose to be presently described. The series of jacks (h) are suspended by a hinge-pin, one to each of the series of heddle levers (d), and their lower ends are connected by wire links (i) with the outer ends of the lower set of levers (e), to keep the heddles under tension between the inner ends of the two sets of levers; and the wire links from the lower ends of the jacks to the lower levers incline outward to draw the jacks against the pattern cylinder (j), or chain, as in the well-known Crompton loom.

The pattern cylinder (j) is rotated with an intermittent motion by a ratchet-wheel (k), deriving motion by a connecting rod (l) from a crank (m) on the main shaft (n) of the loom. When the pattern cylinder
556 or chain is turned, the projections on that section of its periphery

act on some of the jacks and force them inwards, as at (h^1), while the others are retained in their outward position, as at (h^2).

Thus placed, those in the position (h^1) are in a condition to be elevated by a lifter *o* and the others k^2 in a condition to be depressed by a depresser (p), the said lifter and depresser acting on projecting shoulders (q q) on each of the jacks. The lifter and depresser are simply two bars, as represented, sliding up and down in parallel ways (r) and (s), in the framework (see Fig. 4), and the lifter is attached to a sliding vertical bar (t) (see Fig. 3), and the depresser to a like bar (u), connected together by a rocking lever (v), and connecting links (w w), so that when one moves up the other moves down, and vice versa, the lower end of the bar (u) being connected by a joint link (x), with a crank (y), on the main shaft of the loom, so that at each rotation of the shaft, the lifter and the depresser are operated to the required extent to act on the jacks with the view to close one shed and open another.

So far I have described what is known as the Crompton loom, patented as before stated.

The jacks and heddles should about balance each other, and the nearer the better.

Each jack is provided with a holding-down shoulder or hook (z), below the depressing shoulder or hook (q), and on the opposite side with a corresponding holding-up shoulder or hook (a^1) above the lifting-shoulder or hook (q), and there are two holding-bars (b^1) and (b^2) connected into a frame by two levers (c^1 c^1), which vibrate together on an axis about the middle of their length, the fulcrum of one of the said levers bein ; a rocking arbor (e^1), provided with an arm (f^1), which is connected by a jointed rod (g^1) with one end of a lever (i^1), which is acted upon at t other end by a cam (j^1) on the main shaft of the loom, so that at every revolution of the shaft the projection of the cam (j^1) acts on the lever (i^1) and by the connections moves the two bars (b^1) and (b^2) in position relatively to the holding-down and holding-up shoulders (z) (a^1) as to prevent the jacks from moving up or down during the passage of the cam; but as soon as the cam has passed, the weight of parts is sufficient to vibrate the levers (c^1 c^1) to the extent required to clear the bars from the shoulders, and thereby liberate the jacks. It has been already stated that the outer ends of the upper heddle levers are wedge-shaped. They are so formed to be acted upon by a holding bar (k^1) on the upper end of two arms (i^1 l^1) of a rock shaft (m^1), which has another arm (n^1), connected by a jointed rod (o^1) with a lever (p^1), which is drawn up by the tension of a spring (q^1), and forced down by a cam (r^1), on the main shaft of the loom.

557

When the outer wedge-shaped ends of the upper levers are some up and some down, as when a shed has been formed, the cam (r^1) acts on the lever (p^1), the effect of which is to force the holding bar (k^1) into the open wedge-form space between the ends of the levers, and there to hold it until the cam has passed, when the tension of the spring is permitted to draw up the lever which throws out the holding bar to liberate the heddle levers.

Whilst the holding-down and holding-up bars are in action, the jacks cannot be set by the pattern cylinder or chain to make the selection for the next shed; hence it is necessary that these two bars should be moved away while the movement of the pattern cylinder or chain takes place; but it is equally necessary that the jacks should be held in position either up or down while the pattern cylinder or chain acts upon them. This is all accomplished by the above-described mechanism operating in the following order, viz:

So soon as a shed has been opened, the holding bar is forced in between the wedge-shaped ends of the heddle levers, and there remains while the lifter goes down and the depresser goes up each to its place of starting, and also while the holding-up and holding-down bars leave the jacks, and they are acted upon by the pattern cylinder or chain to make the required selection for the next shed; but so soon as this new selection has been made for the next shed, the holding-up and holding-down bars are brought into action by the cam (j^1) so that the holder may liberate the wedge-formed end of the heddle levers to permit the lifter and depresser to lift and depress the jacks to open the new shed according to the selection which has been made. By these means none of the jacks, levers, and heddles are operated for the opening of
558 each succeeding shed, except such as require to be shifted from the upper to the lower or from the lower to the upper portion of the shed.

I am aware that it has been proposed to hold the heddles in their lifted and depressed positions until the warps which they control are required to be shifted from the upper to the lower, or from the lower to the upper surface of the fabric as the design or pattern of the fabric progresses, by holding the jacks either in the elevated or depressed position until the warps require to be shifted; but in such case this has been done by a separate mechanism, operating on each jack, and the mechanism was in consequence too complicated.

I do not wish to be understood as limiting my claim of invention to the special construction herein specified, as the same end may be obtained by equivalent means.

What I claim as my invention, and desire to secure by letters patent, is the employment of the two bars for holding up and holding down such a series of jacks as are not required to be elevated or depressed at the forming of any shed, substantially as described, in combination with the jacks, the pattern cylinder or chain, and the lifter and depresser, substantially as and for the purpose specified.

And I also claim the holder bar which acts on the ends of the heddle levers to hold them in their elevated or depressed position until the beginning of the operation of opening a shed, substantially as described, in combination with the two bars for holding up and holding down such of the jacks as are not required to be shifted during the operation of opening a new shed, substantially as and for the purpose specified.

GEORGE CROMPTON.

Witnesses:
WM. H. BISHOP.
W. C. BROWN.

559 Hon. COMMISSIONER OF PATENTS:

SIR: I have the honor to enclose herewith the specification, duplicate drawings, and certificate for the fee of thirty dollars, in the matter of the application of George Crompton for a patent for improvements in power looms for weaving twilled and figured fabrics.

The model will be sent by express to-day.

I remain, sir, yours, respectfully,

ALEX. P. BROWNE,
By WILLIAM H. BISHOP.

NEW YORK, *March 16th*, 1858.

560 FEBRUARY 21*st*, 1867.

(The complainant puts in evidence the assignment from Moses Marshall to himself, dated May 5th, 1859; also the covenant of Moses

Marshall with him, dated the same day; also the deed of assignment from Moses Marshall to Geo. Crompton, dated 19th day of December, A. D. 1863.)

For and in consideration of the sum of one dollar and other valuable considerations to me in hand paid by George Crompton, of Worcester, in the commonwealth of Massachusetts, the receipt whereof is hereby acknowledged, I, Moses Marshall, of Lowell, in said commonwealth, for myself, my heirs, administrators, executors, and assigns, do covenant and agree to and with the said Crompton, his executors, administrators, and assigns, to sell, assign, and convey to him or them all right, title, and interest whatever in, to, and under any extension or extended term which may be from the United States Patent Office hereafter obtained of certain letters patent of the United States heretofore granted to me for an improvement in looms for weaving figured fabrics bearing date the 11th day of December, A. D. 1849, and numbered 6939; said sale, assignment, and conveyance to be made, and a proper instrument thereof to be executed, within three months after the granting of such extension or extended term, the said Crompton first paying to me therefor the sum of one thousand dollars ($1,000); also, that I will, and my heirs, executors, administrators, and assigns shall, execute all papers, and do all acts that may be lawful and proper, and give my and their reasonable services and exertions to obtain such extension or extended term at the request and at the expense of the said Crompton, his executors, administrators, and assigns.

Witness my hand and seal this fifth day of May, A. D. 1859.

MOSES MARSHALL.

Executed in presence of—
GEORGE STEVENS.

561 Know all men by these presents, that I, Moses Marshall, of Lowell, in the county of Middlesex and commonwealth of Massachusetts, in consideration of three hundred dollars to me paid by George Crompton, of Worcester, in the county of Worcester, gentleman, the receipt whereof is hereby acknowledged, do hereby assign, sell, transfer, and make over, and have truly sold, assigned, transferred, and made over, to said George Crompton, all my right, title, and interest in and to a certain patent for an improvement in looms for weaving figured fabrics, for which letters patent issued to me, numbered 6939 from the U. S. Patent Office, dated Dec. 11, A. D. 1849, to have and to hold to him, the said Crompton, for and during the unexpired term or period for which said letters patent were granted to me only, and to his heirs and legal representatives and assigns.

Meaning and intending hereby to sell, assign, and convey my interest in said patent right for and during the unexpired term for which said letters patent were issued, and reserving hereby to myself and my heirs, executors, and legal representatives, the full and perfect right to said improvement and letters patent that may hereafter be granted or obtained for any and all extension of said patent beyond the term for which letters patent have been granted, to be enjoyed and held by me without interference from the said Crompton for such time as said patent may be extended.

In witness whereof, I have hereunto set my hand and seal on this fifth day of May, A. D. 1859.

MOSES MARSHALL.

In presence of—
S. A. ALGER.
STEPHEN HOSMER.

I, Moses Marshall, who signed and executed the foregoing instrument hereby, on this second day of November, A. D., 1859, hereby consent to and do hereby change the foregoing instrument so far as to add
562 after the word "representation," in the 20th line thereof, the words "and assigns," so that the foregoing shall make "to his heirs and legal representatives and assigns," and both the parties to the foregoing instrument consent to the change aforesaid by subscribing their names hereto. In witness whereof, we have hereto subscribed our hands and seals the day and year aforesaid.

MOSES MARSHALL.
GEORGE CROMPTON.

In presence of—
S. A. ALGER.
JOHN DAVIS.

U. S. PATENT OFFICE.

Received, June 27, and recorded July 14, 1859, in Liber I[5], page 363, of Transfers of Patents. In testimony whereof, I have caused the seal of the Patent Office to be hereunto affixed.

WM. D. BISHOP,
Commissioner of Patents.

For and in consideration of the sum of one dollar and other valuable considerations to me, Moses Marshall, of Lowell, Massachusetts, paid by George Crompton, of Worcester, Massachusetts, the receipt whereof is hereby acknowledged, I have assigned, sold, and transferred, and do hereby assign, sell, and transfer unto the said George Crompton, his heirs, administrators, and assigns, all the remaining extended term of letters patent of the United States originally granted to me 11th December, 1849, for improvements in looms for weaving figured fabrics, reissued April 24th, 1860, and extended by the Commissioner of Patents for the further term of seven years, with all right, title, and interest whatever in, to, and under said extended term; the same to be held and enjoyed by the said George Crompton, his heirs, administrators, and as-
563 signs for his and their own use and behoof, to the full end of the said term of seven years, as fully to all intents and purposes, as I might myself hold and enjoy the same if this assignment were not made.

Witness my hand and seal the nineteenth day of December, A. D. one thousand eight hundred and sixty-three.

MOSES MARSHALL.

Signed, sealed, and delivered in presence of—
J. E. MAYNADIER.

UNITED STATES PATENT OFFICE.

Received, March 29th, and recorded April 5th, 1864, in Liber G, page 409, of Transfers of Patents. In testimony whereof, I have caused the seal of the Patent Office to be hereunto affixed.

D. P. HOLLOWAY,
Commissioner of Patents.

THE DISTRICT OF NEW HAMPSHIRE, *ss:*

I, Albert R. Hatch, clerk of the circuit court of the United States for the said district, do certify that the foregoing, from printed page 20 to

printed page 563, inclusive, are copies of the exhibits and depositions used at the hearing of the suit in equity of George Crompton vs. the Belknap Mills & al., heretofore pending in said court.

Witness the seal of said court this first day of July, A. D. 1869.

[SEAL] ALBERT R. HATCH, *Clerk.*

(Indorsement on record:) N. Hampshire C. C. U. S. No. 248. George Crompton, appellant, vs. the Belknap Mills.

Filed 20th August, 1869.